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FINAL REPORT

FUNCTIONAL DESIGN SPECIFICATION

NASA FORM 1510

November 15, 1979

(NASA-CR-162513) FUNCTIONAL DESIGN
SPECIFICATION: NASA FORM 1510 Final report
(Information Planning Associates, Inc.)
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G3/81 15433

for

Technical and Support Facilities Branch
Facilities Division
National Aeronautics and Space Administration
Washington, DC 20546

by

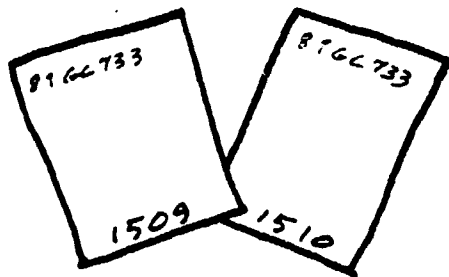
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1. INTRODUCTION TO THE NASA Form 1510

1.1 WHAT IS THE 1510?



1) One 1510 per 1509

The 1509 and the 1510 are a pair. Each facility project must have one 1509 and one 1510.

The project code identifies the 1509 and the 1510.

2) The 1510 Shows Costs

The 1510 is a costing worksheet. It contains the details of the cost which appears on the 1509. Thus, the bottom line of the 1510 becomes the "AFPCE Total" on the 1509, the "Approved Facility Project Cost Estimate".



"AFPCE TOTAL"

II. Related Costs

1.	\$ —
2.	—
3.	—
4.	—
5.	—
6.	—
7.	—
8.	—

III. Future Funding Plan

\$ —

IV. Activation Costs

\$ —

V. Other Costs

\$ —

3) Not All Costs Add Up to the Bottom Line

The 1510 shows several kinds of costs. Only one kind is involved in the calculations which lead to the bottom line amount. Other kinds of costs are:

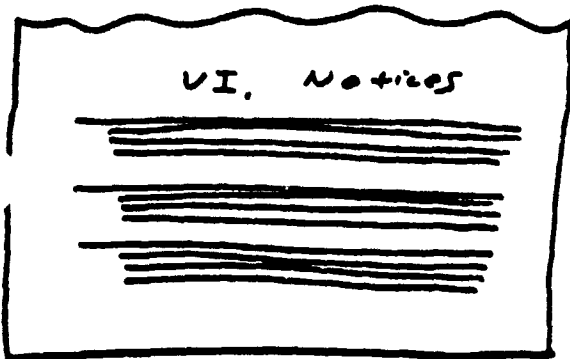
- . Related Costs. These comprise 8 categories (fixed) with up to 10 entries (variable) in each. The Q1 operator inputs the title and cost of each entry. The Q1 must add the items within each category. No further calculations are done.
- . Future Funding Plan. This is a single dollar amount, output exactly as input.
- . Activation Costs. Same
- . Other Costs. Same

Title	_____	Date	_____
Project #	_____	Submission	_____
Installation	_____	Office	_____
:		:	

I. Summary

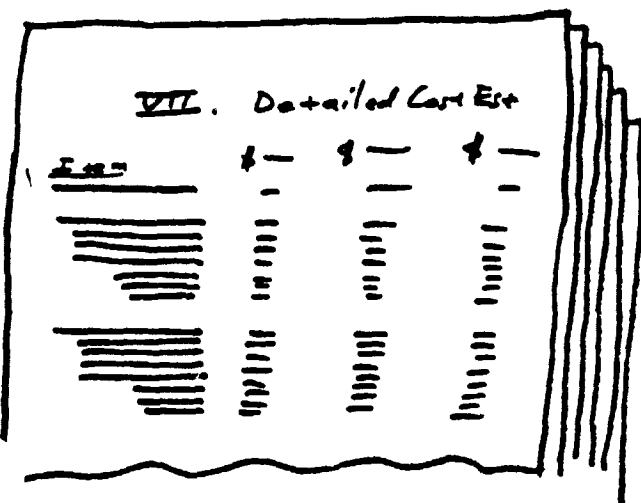
4) The 1510 Contains Data from the 1509 Data Base

The identification data at the top of the 1510 (and in page headings on subsequent pages) is taken from data in the 1509 data base. It is not duplicated in storage for the 1510.



5) The 1510 Contains Text

Part VI of the 1510 contains 12 items of about 330 characters each.



6) Most of the 1510 Is In Part VII, the "Detailed Cost Estimate"

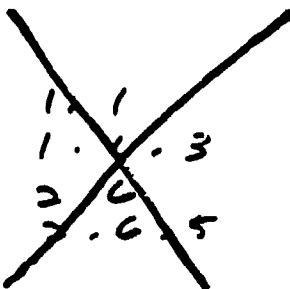
The Detailed Cost Estimate contains the basic cost information. Calculations on this yield the bottom line.

The number of detailed cost lines can vary from a handful to 1,000.

12 = WORK PACKAGE
 2 = MAJOR ELEMENT
 3 = System
 4 = Subsystem
 5 = Component

7) The Detailed Costs Are Arranged Hierarchically

There are five levels of costs within the detailed cost estimate. Not all levels are always used. But subtotals are taken at each level.



8) There Is No Numbering Scheme

Within the Detailed Cost Estimate data, there are no line numbers. Items are entered in sequence, inserted in sequence, and typed out in sequence. Obviously, the sequence must be recorded.

Very large insertions will be the rule.

1.2 HOW NASA USES THE 1510

NASA revises the 1510 frequently between the time a project is first proposed and the time construction begins.

1. THE 1510 GROWS LARGER WITH TIME

As the project is designed in more detail, the cost estimate also becomes more detailed. Thus, line items are added to the detailed cost estimate part of the 1510.

<u>Project Phase</u>	<u>Typical # of 1510 Detailed Cost Line Items</u>
. Initial proposal	10
. Preliminary Engineering Report (PER). An engineering firm is hired to estimate the cost of the proposed building in some detail.	75
. Budget approval. (Most projects are approved based on the 1510 which is based on the PER.)	75
. Final Design. Here, the building is ready to go out for bids.	300

2. DURING FINAL DESIGN, ALTERNATE DESIGNS ARE COSTED

By final design time, a budget has been set for the project. This means that the architects and engineers are designing to a cost. If the project looks to be over budget, they will change the design and re-figure the cost. This may happen several times.

This is where a "What If" capability would be useful -- to calculate the costs of all of these trial designs. Since these calculations are exactly what the Q1 will do for the 1510, a Whatif capability has been included as part of the 1510 software requirements.

1.3 WHAT THE Q1 WILL DO

The 1510 application entails four Q1 functions:

- . Data entry
- . Printout the 1510
- . Whatif (Calculate the project cost if these lines are changed like so...)
- . Data base manipulations (Delete projects, extract projects, merge data bases, and so on.)

2. OVERVIEW

The best overview of the 1510 application can be had by:

- . Looking at the sample NASA Form 1510 in Appendix A. Understand that this is not a pre-printed form; the Q1 creates it on blank paper.
- . Studying the suggested program structure which follows, as well as the description of what each module does.
- . Reading section 2.1, "Data Base Considerations"

2.1 DATA BASE CONSIDERATIONS

The data for each 1510 can be logically divided into these categories:

- . Fixed-amount Data. These are circled in blue on Figure 2-1. Every 1510 contains the same amount of this data. It is output exactly as input.
- . Cost Estimate Data. These are circled in yellow on Figure 2-1. The amount of these data varies with the size of the project. Large projects will have many more records than small projects will. These data fall logically into two record types:
 - Work package line items
 - Other line items

The last page of Figure 2-1 shows these line items. The 1510 contains 5 levels of line item, but they all contain the same information except for the highest level, the work package. On output, the line items are indented and underscored according to the level of the item. The level is one of the data fields.

- . Calculated Data. These are circled in magenta on Figure 2-1. These are all calculated by the Q1. Calculations are done on output; these values are not stored in the data base.

Almost all of the calculated data appears in Part I of the 1510.

1. CALCULATE ON OUTPUT

The calculations should be done on output in order to simplify the operator procedures.

Do not introduce a separate, operator-initiated calculation step between input and output. Such an approach would require the operator to keep track of whether or not the calculations had been run. The operators will not do this. The upshot will be outdated and incorrect values appearing on the 1510. This is unacceptable.

NASA Form 1510
FACILITY PROJECT COST ESTIMATE

Project Code: 81JC459 / 81006
Title: CONSTRUCTION OF RESEARCH ANALYSIS CENTER
Project #: 5337
Installation: MAF/MSFC

Date: 02/16/79
Submission: B
Revision: 0
Program Ofc: OSTDS

Basis of Eng'g Cost Est: Preliminary Engineering Report

Basic engineering cost estimate data in Part VII include escalation through: 04/02/76

I. SUMMARY OF COST ESTIMATE

Item	Contin- gency	Unit	Quant.	Unit Cost		Total Cost	
				Eng'g	Budget	Eng'g	Budget
LAND ACQUISITION	2	ACRE	5	2,150.00	4,250.00	10,750	21,249
Loc=CLE Mid-pt Constr=10/80							
Av ann. cost adj rate=9.0%							
SI&E Services rate=1.5%							
Construction Mgt rate=0.0%							
OFFICE WING	11	SQFT	6,300	51.81	102.41	326,400	645,209
Loc=CLE Mid-pt Constr=03/81							
Av ann. cost adj rate=9.0%							
SI&E Services rate=1.0%							
Construction Mgt rate=6.0%							
Structural	13					11,655	23,039
Architectural	8	SQFT	6,300	28.88	57.42	181,949	361,752
Mechanical	11					37,741	74,604
Electrical	20					94,000	185,814
LABORATORY WING	6					2,547,510	5,035,771
Loc=CLE Mid-pt Constr=06/81							
Av ann. cost adj rate=9.5%							
SI&E Services rate=1.0%							
Construction Mgt rate=6.0%							
Structural	5					86,444	170,875
Architectural	6					1,860,458	3,677,646
Mechanical	4					600,608	1,187,247
EQUIPMENT	25					213,507	328,950
Loc=NYC Mid-pt Constr=12/80							
Av ann. cost adj rate=10.3%							
SI&E Services rate=5.5%							
Construction Mgt rate=0.0%							
FALLOUT SHELTER	0					0	0
Loc=CLE Mid-pt Constr=04/81							
Av ann. cost adj rate=9.0%							
SI&E Services rate=0.0%							
Construction Mgt rate=0.0%							

REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

- Fixed-amount data, output as input
- - - Data from the 1509
- Cost estimate data, output as input
- Calculated values 2-3

CONSTRUCTION OF RESEARCH ANALYSIS CENTER /
Project code: 81JC459 Date: 02/16/79

Submission: B

PAGE 2
NASA Form 1510

TOTAL ENGINEERING COST	\$3,051,070
Cost Adjustments	2,227,281
SUBTOTAL	\$5,278,351
Contingencies	361,424 (6.8%)
Supervision, Inspection & Engineering Services	70,313
Construction Management	298,591
Other Burden Costs	22,500
Transfer Helicopter Test Pad	20,500
Transfer Misc. Equipment	2,000
TOTAL BUDGET ESTIMATE	\$6,031,179

ANNUAL COST ADJUSTMENT RATES USED

Percentages

(Source: Table dated 08/79 prepared by the center)

Location	1976	1977	1978	1979	1980	1981
CLE	10.9	11.7	12.0	12.5	12.6	12.4
NYC	10.9	11.5	11.8	12.2	12.0	12.0

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ORIGINAL PAGE IS POOR

- Data from the Cost Adjustment Table

II. RELATED COSTS

	Manyears	\$ Amount
1. Annual Operations & Maintenance Cost, excluding energy	-3	-108,000
2. Annual Energy Cost		-16,000
3. Purchases of Noncollateral Eqpt	Fund Source Year	
Precision Framistan	6 1980	106,500
Plug for Precision Framistan	6 1976	106,498
		2
4. Transfer as Excess, Collateral Eqpt (Include transfer costs in project cost estimate)		129,500
Helicopter Test Pad		115,000
Miscellaneous Equipment		14,500
5. Transfer as Excess, Noncollateral Eqpt		***
6. Existing Collateral Eqpt		99,999,999
Spare Fuses		49,974,379
Spare Floppy Disks		49,999,991
Spare Q1's		16
Certified Gizmos		19,613
Mixed Gizmos & Lemons		6,000
7. Existing Noncollateral Eqpt		0
8. Design Costs		88,000
Conceptual Study Funded by R&D		0
Special Studies		0
PER		0
Design.		88,000

III. FUTURE FUNDING PLAN

Fiscal Year: 1984 Amount: 654,321

IV. ACTIVATION COSTS

Amount: 99,999,999

V. OTHER COSTS

Amount: 99,999,999

*** No value supplied

VI. NOTICES

ENERGY/NATURAL RESOURCES: The scope of this project involves no substantial change in commitment of energy or natural resources.

ENVIRONMENTAL STATEMENT: This work is normal for the ongoing activities of JSC and is generally covered by the Institutional Environmental Impact Statement for the center, published in 1971. The scope of this project involves no additional significant environmental impact.

FLOODPLAIN: This facility does not involve floodplains. E.O. #11988 has been followed.

AIR & WATER POLLUTION CONTROL: This facility cost estimate includes funds for a water treatment system for wastes from the laboratory. The project complies with OMB Circular A-106 and E.O. #11752.

RANDOLPH-SHEPPARD ACT: The scope of this project does not provide for a permanent material change in the floor area of any building. Consequently, the consideration of vending facilities for the blind as required by the Randolph-Sheppard Act amendments of 1974 (Public Law 93-516) is not applicable to this project.

PHYSICALLY HANDICAPPED: Provision for access by handicapped persons will be provided consistent with P.L. 90-480.

OCCUPATIONAL SAFETY: This facility cost estimate includes amounts required to ensure safe and healthful work places for Federal employees consistent with the Occupational Safety and Health Act of 1970, E.O. #11807, and provisions of the Department of Labor.

STATE & LOCAL COORDINATION: This facility will not have a significant impact on the local area; OMB Circular A-95 does not apply.

AUTOMATIC DATA PROCESSING EQUIPMENT: This facility project includes no funds for the acquisition of ADP equipment. The ADP acquisition policies of GSA Federal Management Circular 74-5 do not apply.

UNFORSEEN PROGRAMMATIC NEEDS: This facility is not proposed due to an unforeseen programmatic need.

ENDANGERED SPECIES:

HISTORICAL PRESERVATION:

CONSTRUCTION OF RESEARCH ANALYSIS CENTER

Project code: 81JC459

Date: 02/16/79

Submission: B

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VII. DETAILED COST ESTIMATE

Item	Contin- Agency	Unit of Measure	Quantity	Unit Cost Eng's	Total Cost Eng's
<u>LAND ACQUISITION</u>	2	ACRE	5	2,150.00	10,750
Loc=CLE Mid-pt Constr=10/80					
SI&E Svcs= 1.5%=\$					
Constr Mgt= %=\$ 0					
<u>OFFICE WING</u>		SQFT	6,300		[326,400]
Loc=CLE Mid-pt Constr=03/81					
SI&E Svcs= %=\$ 5,157					
Constr Mgt= %=\$ 30,943					
<u>STRUCTURAL</u>	10				[11,655]
<u>Elevator Cross-Over</u>					[566]
Steel Beams		LB	800	.40	320
Galv Mtl Deck		SQFT	70	2.25	158
Conc Topping		SQFT	70	1.25	88
<u>Toilet & Corridor Areas</u>					[11,089]
Mtl Deck on Lt Ga Mtl Fram'g	14	SQFT	3,483	2.25	7,837
Allwnc for Underp'g & Lintl		EA	1	3,252.00	3,252
<u>ARCHITECTURAL</u>		SQFT	6,300		[181,949]
<u>Acoustical</u>					[20,024]
Dense Mineral Tile in Grid	3	SQFT	6,386	2.13	13,602
Glue-On Vermin-proof Tile	6	SQFT	3,015	2.13	6,422
Vermin Control Joints	5	L.F.	5,813	.73	4,243
<u>Metal Items</u>	7				[56,287]
H.M. Doors & Frames					[40,192]
Single		EA	42	335.00	14,070
Double		EA	11	457.00	5,027
S.S. Clad Doors	10	EA	20	998.00	19,960
Roll-up Door		EA	1	1,135.00	1,135
7' S.S. Corner Guards		EA	14	61.00	854
S.S. Bumper Rails	10	L.F.	525	6.00	3,150
6' Chain Link Fence, 3-strand					[7,324]
Wire Fencing		L.F.	457	10.67	4,876
16' x 6' Gates		EA	3	816.00	2,448
Toilet Room Lockers		EA	53	75.00	3,975
Vanities		L.F.	22	36.00	792
<u>Lathe and Plaster</u>	2	S.Y.	2,073	9.75	20,212
<u>Computer Floor in D.O.C.R.</u>	6	S.F.	341	8.00	2,728
Loc=NYC Mid-pt Constr=12/80					
<u>Finish Hardware</u>	10				[3,545]
Kick Plates		EA	21	21.94	461
Door Closers		EA	46	67.05	3,084

It also makes no sense to tie the calculations to the inputting step. Every time the operator exited the data base (after fixing a typo, to pause for lunch...) the calculations would have to be redone. Assuming that the calculations will take a noticeable amount of time, this arrangement would be frustrating to the operators and a waste of their time.

2. FILE STRUCTURE

The file structure(s) is left for PRC to determine. This much can be said; the application will have at least:

- . Data on each 1510
- . Access to the 1509 data for each project
- . A cost adjustment table -- one short file for each center (See Appendix C)
- . The program files
- . A scratch file. Used by WHATIF, it holds a copy of the cost estimate data for the project which is being modified by WHATIF.

3. FLOPPY DISK vs. HARD DISK

Like the 1509's, the 1510's should be put on the hard disk. This will speed processing.

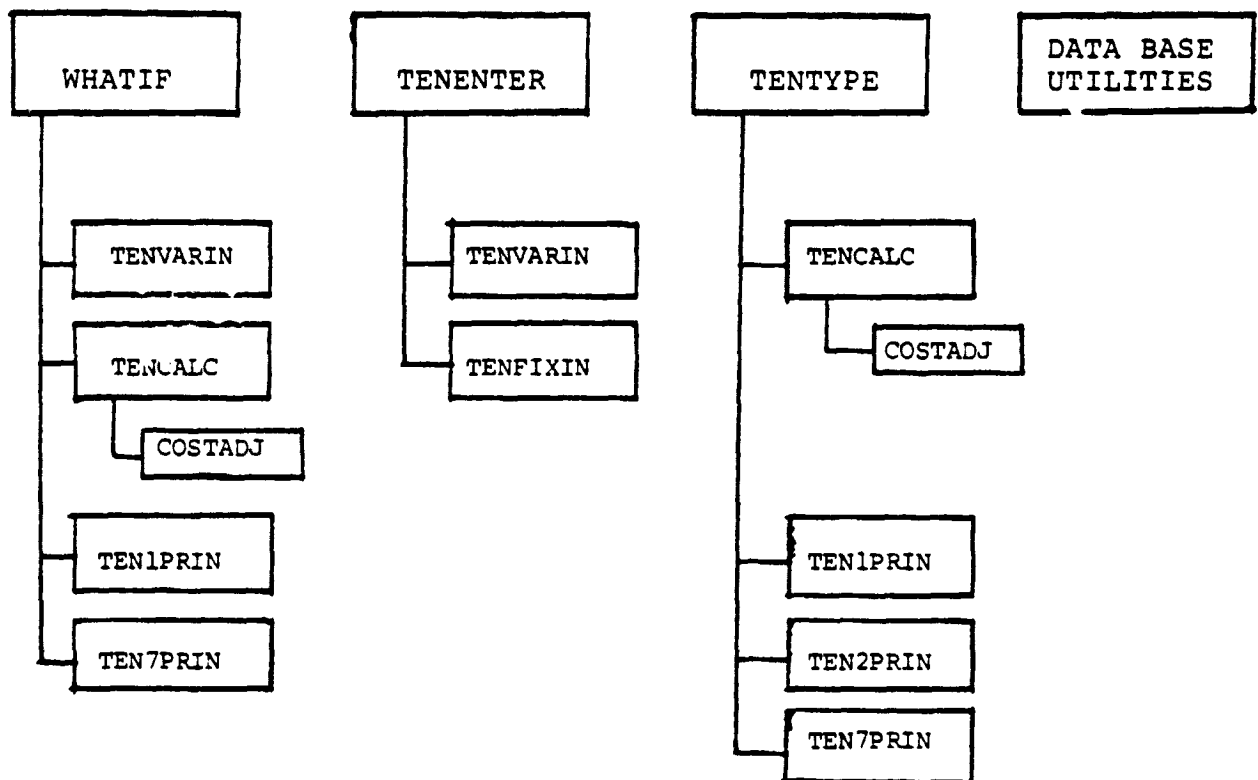
However, centers must be able to transfer data through the mail on floppy disks. These data consist of one or more 1510's plus (always) the center's most recent cost adjustment table.

4. STORAGE REQUIREMENTS

See Appendix F.

2.2 PROGRAM STRUCTURE

Shown below is a suggested program structure for the 1510 application. While not binding, it shows the functions which the application must perform.



1. MODULES

TENENTER This is the data entry program. It prompts the operator for the 1510 data. Used to open a new 1510, add data to an old one, update an old one, and delete data from an old one.

TENTYPE This types the 1510. It also generates the calculated cost estimate data which appears on the 1510.

WHATIF This concerns the cost estimate data almost exclusively. It allows engineers to see what the cost of a project would be if various data were changed. It begins by copying certain 1510 data to a scratch file. It then lets the operator modify that data via the same procedures used in TENENTER. It then calculates the project cost in the same way that TENTYPE does. It then prints in a fashion similar to TENTYPE.

DATA BASE UTILITIES These let the operator manipulate whole projects in the data base. Common operations include:

- Backup the data base
- Delete this entire project
- Extract this project and put it in a floppy to mail to Headquarters
- Update the data base by substituting the data on this floppy from center X, creating new projects where required.

2. SUBMODULES

Unlike the modules, the submodules are operator-transparent. They are all initiated by modules, not by the operator.

In suggesting this scheme of submodules, the driver has been the needs of WHATIF. Because WHATIF uses selected parts of TENENTER and TENTYPE, I have tried to make those parts discrete. The designer should thoroughly understand the scope of the various WHATIF operations before settling on a program structure.

TENVARIN This handles data entry and updating of the cost estimating data. This is the data which consists of a variable number of records.

TENFIXIN This handles data entry and updating of the fixed-length data.

TENCALC This generates all of the calculated values which appear in Part I, Summary, of the 1510 and in the WHATIF outputs.

COSTADJ is a subprogram which calculates the cost adjustment for a given line. It makes use of the Cost Adjustment Table, a small file of inflation rates which the center will put on the Q1.

Three print submodules are in order. The only reason for dividing the printing process into three parts is that WHATIF uses only parts of the printing process.

TEN1PRIN This types the identification header on the 1510 as well as Part I, Summary.

TEN2PRIN This types Parts II through VI of the 1510. WHATIF does not use this.

TEN7PRIN This types Part VII of the 1510.

3. RELATIONSHIP OF THE 1510 TO THE 1509

There is a one-to-one relationship between the 1509 and the 1510. Every facility project has one of each. Basically:

- . The 1509 describes the project -- what it is, why it's needed, when it will be built and how much it will cost, in total.
- . The 1510 concerns only costs. It gives all of the details of the project cost which appeared on the 1509.

1. TIMING

Sometimes the 1509 is written first, sometimes the 1510 is. The 1510 may be revised several times before the 1509 is.

2. COMMON DATA

Certain data elements are used by both the 1509 and the 1510. These data elements are all stored in the 1509 data base. The 1510 software reads (only reads) this data base when these elements are required. Except for the project code, the data is not duplicated in the 1510 data base.

1509 Data Used by the 1510

1509/1510 Date
Submission
Revision
Title
Project #
Installation
Program Office
Construction Start Date
Construction Completion Date

If these 1509 data elements are missing or blank, the 1510 software will take various action as specified in the chapter concerning TENTYPE and in Appendix D concerning the cost adjustment calculations.

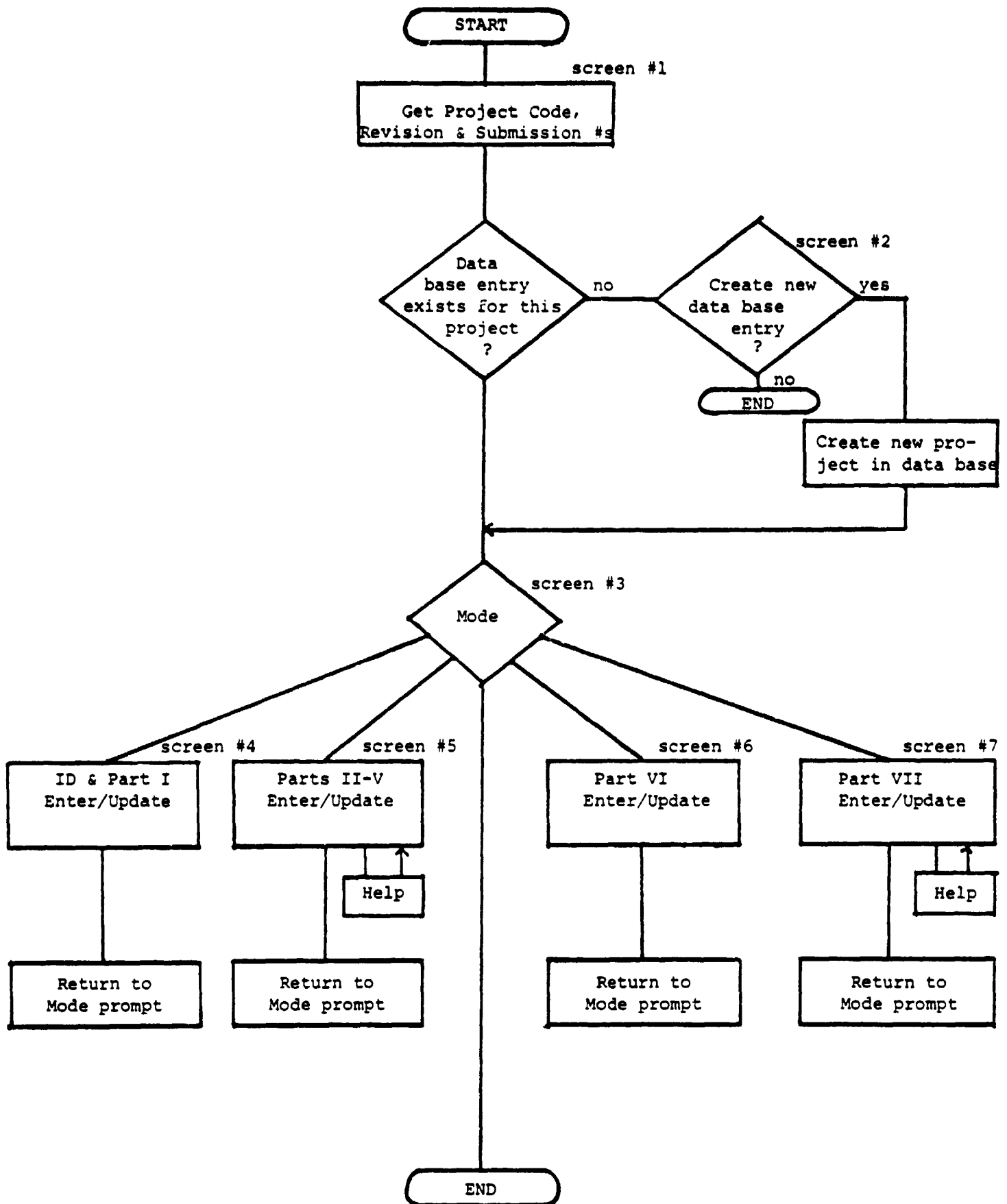
4. FUNCTION #1: INPUT 1510's -- TENENTER

TENENTER is the 1510 input program. The original model for the program is Q1's FORM. Changes are as follows:

- . A file creation module has been added. This lets the operator create a new 1510 as part of TENENTER, instead of as a separate step.
- . FORM deals with a data base with a variable number of records per file. Only part of the 1510 is set up that way -- Part VII. Parts I-VI are fixed for every 1510. Thus TENENTER has modules which deal with these fixed portions as well as a module which deals with Part VII.
- . The file structure which TENENTER uses is to be determined by PRC.
- . Parts of TENENTER are used by WHATIF. This requires a modular approach to those parts.
- . In the part of TENENTER which deals with Part VII and variable numbers of logical records, the records are arranged hierarchically, unlike those in FORM. This structure requires the program to keep track of its place in the hierarchy; all logical records are thus not equal.

These and other aspects of TENENTER will be clarified by reference to Figure 4-1 and the screen displays which follow.

FIGURE 4-1
TENENTER Flow



SCREEN #1: Project Code

TENENTER	
(Version 1.0 10/30/79)	
PROJECT CODE:	■
SUBMISSION:	■
REVISION:	■

SCREEN #2: New Project

TENENTER	
81GC733 NOT FOUND!	
SHALL I ADD 81GC733 TO THE DATA BASE(Y or N)? ■	

Insert the project code which was entered in the previous step.

SCREEN #3: Mode

81GC733	TENENTER
CHOOSE PART	
1 = Identification and Part I, Summary	
2 = Parts II through V	
6 = Part VI, Notices	
7 = Part VII, Detailed Cost Estimate	
■	
Press FINISH to return to NEUTRAL MODE.	

SCREEN #4: ID and Part I

81GC733	ID & PART I	TENENTER
DATE OF ENG'G COST EST(mm/dd/yy): @@/@@/@@		
BASIS OF ENG'G COST EST: @@@@		
OTHER BURDEN COSTS		
@@@@	@@@@	\$@@@@
@@@@	@@@@	\$@@@@
@@@@	@@@@	\$@@@@
@@@@	@@@@	\$@@@@
@@@@	@@@@	\$@@@@
@@@@	@@@@	\$@@@@
Note: Other ID data is taken from the 1509		

NOTES:

1. When the display appears, it shows all data currently in the data base for this project.

2. Edit Checks

- a) Dollar amounts are checked for all-numeric. The decimal point is assumed after the last character. Error message is:

ONLY NUMBERS WILL WORK HERE, NO COMMAS

- b) The Date of Eng'g Cost Estimate is checked for format 99/99/99. Error message is:

TRY AGAIN. THE DATE MUST USE FORMAT mm/dd/yy

Display error messages on the last line of the display while retaining the rest of the display.

3. Key Functions

FINISH key = Returns to the mode p ompt
F1 = Moves the cursor to the previous field
F2 = Moves the cursor to the next field
Other keys = No effect. Disable the other function keys.

SCREEN #5a: First Part II Display

```

81GC733          PARTS II-V          F6=Help
PART II  Item 1  O&M Cost
                        Manyears: @  $@@@@@@@

          Item 2  Energy Cost          $@@@@@@@

```

Key functions are:

```

FINISH key = Returns to the mode prompt
F1         = Moves the cursor to the previous field
F2         = Moves the cursor to the next field
F6         = Displays Help screen
F10        = Previous Part II-V screen
F11        = Next Part II-V screen

```

Error checks are for all-numeric. Display error message on line #1, retaining the rest of the display.

SCREEN #5b: Second Part II Display

[illegible]

Key functions and error checks as for screen #5a.

SCREEN #5c: Third Part II Display

[illegible]

SCREEN #5d: Fourth Part II Display

81GC733	PARTS II-V	F6=Help
Item 5:	Transfer, Non-Col Eqpt	\$@@@@@@@@
-	@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@	\$@@@@@@@@
Etc for 10 lines total		

SCREEN #5e: Fifth Part II Display

81GC733	PARTS II-V	F6=Help
Item 6:	Existing Col Eqpt	\$@@@@@@@@
-	@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@	\$@@@@@@@@
Etc for 10 lines total		

SCREEN #5f: Sixth Part II Display

81GC733	PARTS II-V	F6=Help
Item 7:	Existing Non-Col Eqpt	\$@@@@@@@@
-	@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@	\$@@@@@@@@
Etc for 10 lines		

SCREEN #5g: Seventh Part II Display

81GC733	PARTS II-V	F6=Help
PART II		
Item 8:	Design Costs	\$@@@@@@@@
	Conceptual Study	\$@@@@@@@@
	Special Studies	\$@@@@@@@@
	PER	\$@@@@@@@@
	Design	\$@@@@@@@@
PART III	FUTURE FUNDING Year: 19@@	\$@@@@@@@@
PART IV	ACTIVATION COSTS	\$@@@@@@@@
PART V	OTHER COSTS	\$@@@@@@@@
F7 = Finish		

SCREEN # 52: Part II Help Display

```

                                HELP

FINISH key = The way out of Parts II-V
  F10      = Previous screen
  F11      = Next screen
  TOP key  = First Part II screen

Note:  Items 3 to 7.  If you have sub-items,
       leave the total item $ amount blank.

       Press RETURN to RETURN

```

SCREEN #6: Typical Part VI Display

40x
40 →

```

81GC733          PART VI          TENENTER
                NOTICES

ENERGY/NATURAL RESOURCES: @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
                                F7 = Finish

```

Each of the 12 items in Part VI will fit in 7 display lines, including the title.

Key functions are:

```

FINISH key = Return to mode prompt
  F10      = Previous Part VI screen
  F11      = Next Part VI screen
DEL CHAR   = Delete character and close up text
              across entire entry.
INSRT MODE = As in Q1's FORM program.

```

There are no error checks in Part VI

SCREEN #7: Detailed Cost Estimate Screens

These screens comprise the following:

- a) Level selector, used when inputting new line items
- b) A screen for each type of line item:
 - Work package
 - Major element
 - System
 - Subsystem
 - Component
- c) Search screen, for initiating a search
- d) Part VII Help screen

In general, the program acts like Q1's FORM: The operator sees one record at a time. The data base has a sequence which is important. The operator can search for the record of interest. The operator can move easily to the next record or the previous record and can move among fields within a record.

To the FORM features, are added these:

- . Certain edit checks are provided. These take effect as the operator attempts to leave a record. If the data on the record does not pass the edit checks, the operator is shown the record with an error message.
- . The program keeps track of its place within the hierarchy of line items. The Q1 displays not only the data in each record, but also data from those records to which the record is logically subordinate.

Because of this approach, the operator can always see the context of every line item. This is important since the line items are not numbered.

Key functions are the same as elsewhere in the 1509/1510 applications:

- FINISH key = Return to the mode prompt
- F10 = Display previous record
- F11 = Display next record
- K8-TOP key = Display first record
- K4-DEL P = Delete the record now displayed
- K6 = Insert a record after the record showing.
(This inserts one record only. It does not turn on an insert-record mode.)
- K7 SEARCH = Call search screen; then execute search
- F6 = Call Help screen
- RETURN = An alternate way of executing Search; returns to program from Help screen

F1 = Move cursor to previous field
F2 = Move cursor to next field
DEL CHAR = As in FORM
INSRT MODE= As in FORM

SCREEN #7a: Insert New Line Item

INSERT NEW LINE ITEM	
SELECT LEVEL: █	
1 =	Work Package
2 =	Major Element
3 =	System
4 =	Subsystem
5 =	Component

This screen appears when the K6, insert record key is pressed.

The system should reject entries which would create gaps in the hierarchy of line items. For instance, if the last line item were a System, then this new line item could be of any level except a Component. A Component would be invalid because there is no subsystem that it could be part of. In such cases, the program should give an error message as follows:

SORRY, YOU CANNOT BYPASS A LEVEL GOING DOWN.
THIS NEXT LINE MUST BE A _____
OR HIGHER.

Substitute the word(s) for the level next below that of the previous record.

SCREEN #7b: Work Package Screen

```

81GC733                                FORMAT: ALL CAPS
Work Package      @@@@
SI&E Services=@@.@% or $@@@@@
Constr Mgt       =@@.@% or $@@@@@

Contingency @@@      Unit of Measure      @@@@
                        Quantity              @@@@@@
                        Unit Cost(Eng'g)    $@@@@@@@@@
Location=@@@  Mid-pt of Constr(mm/yy)=@@/@@
F6=Help      F7=FINISH

```

Put the keyboard in upper case for all entries.

Do edit check for all-numeric or blank in percent, dollar, date and Quantity fields. However:

SI&E Services and Constr Mgt fields may contain
either a percent or a dollar amount but not both.
The unused field is blank.

Display error messages on line 12 while also showing the rest of the display.

SCREEN #7c: Major Element Screen

```

81GC733                                FORMAT: ALL CAPS
Work Package      OFFICE WING
Major Element    @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
System
Subsystem
Component
Contingency @@%      Unit of Measure      @@@@
                    Quantity                @@@@@@
                    Unit Cost (Eng'g)      $@@@@@@@@@
Location=@@@ Mid-pt of Constr(mm/yy)=@@/@@
                    F6=Help                F7=FINISH

```

Put the keyboard in upper case for all fields.

Display the name of the work package within which this Major Element is located. The work package name is not changeable here. Lower level names are blank and not changeable here.

Do edit checks as with the Work Package Screen.

SCREEN #7d: System Screen

E1GC733		FORMAT: Initial Caps	
Work Package	OFFICE WING		
Major Element	ARCHITECTURAL		
System	@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@		
Subsystem			
Component			
Contingency @@%	Unit of Measure	@@@	
	Quantity	@@@@@	
	Unit Cost (Eng'g)	\$@@@@@@@	
Location=@@@	Mid-pt of Constr(mm/yy)=@@/@@		
F6=Help	F7=FINISH		

Put the keyboard in lower case for the system name;
upper case for all other fields.

In other respects, this is handled exactly like the
Major Element screen.

SCREEN #7e: Subsystem Screen

Do this like the System screen. The format for the
 subsystem name is initial caps.

SCREEN #7f: Component Screen

Do this like the System screen, too. The format for the
 component name is initial caps.

SCREEN #7g: Search Selection

SEARCH	
Work Package	@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
Major Element	@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
System	@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
Subsystem	@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
Component	@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@

To search, press SEARCH or RETURN

Put the keyboard in upper case for the first two fields, lower case for the last three.

The line item names tend to be very similar. Therefore, a full 28-character search string is recommended if it can be accommodated.

The operator should tab to the level of choice, enter the line item name as a search string and press SEARCH (K7) again. The RETURN key should also execute the search because that is an option in the Q1's word processing software.

The search might be expedited if the level code were part of a key. In any event, the search logic must find the names of the higher-level parts within which the sought line item resides.

SCREEN #7z: Part VII Help Display

HELP	
FINISH key	= The way out of Part VII
TOP key	= The first line item
F10	= The previous line item
F11	= The next line item
DEL P	= Delete the line item
K6	= Insert one line item (one only)
SEARCH	= Search
F1	= Move cursor to previous field
F2	= Move cursor to next field
Press RETURN to RETURN	

5. FUNCTION #2: TYPE 1510's -- TENTYPE

TENTYPE takes the 1510 data, performs certain calculations on it, and types the NASA Form 1510.

The term "NASA Form 1510" is something of a misnomer since this application will do away with the Form 1510 as a pre-printed item. TENTYPE types on plain paper.

1. GENERAL FEATURES

- 1) Paper & Font. The printout should be on 8½x11" continuous-form paper using a 12-pitch font.
- 2) One 1510 at a Time. TENTYPE will type one 1510 at a time. No provision is made for typing several 1510's in sequence.
- 3) Data Sources. Data for the 1510 comes from three places:

- . The 1510 data base
- . The 1509 data base
- . The center's Cost Adjustment Table

The Cost Adjustment Table is used in the summary calculations. Its use and layout are described in Appendices C, D & E.

The 1509 data comprises:

- . Date
- . Submission
- . Revision
- . Title
- . Project #
- . Installation
- . Program Office
- . Construction Start Date
- . Construction Completion Date

The last two items are used in the calculations. The other items appear at the top of the 1510 and on page headings.

NOTE: TENTYPE will attempt to get heading data from the 1509. If no 1509 exists or if the data is blank, TENTYPE will type anyway, inserting blanks in the missing fields.

- 4) Cost Adjustment Switch. The program must run either with or without the cost adjustment logic, depending on the operator's response to a prompt.
- 5) Restart. A restart capability is needed, of two kinds:
 - . Restart at the top of the 1510, but skip the calculation phase. This requires that the results of the calculations be written to a scratch file for use if restart becomes necessary.
 - . Restart within Part VII. This is the variable portion of the 1510. It could be as long as 50 or 60 pages, though 20 pages is more common. A restart here is essential, again skipping the calculation phase.

No restart need be provided between the top of the 1510 and the beginning of Part VII (which always begins at the top of a page).

2. TENTYPE FLOW

Figure 5-1 shows the logical progression of TENTYPE. For details of the subprogram TENCALC see Appendix C. That subprogram is used by both TENTYPE and WHATIF.

Some notes:

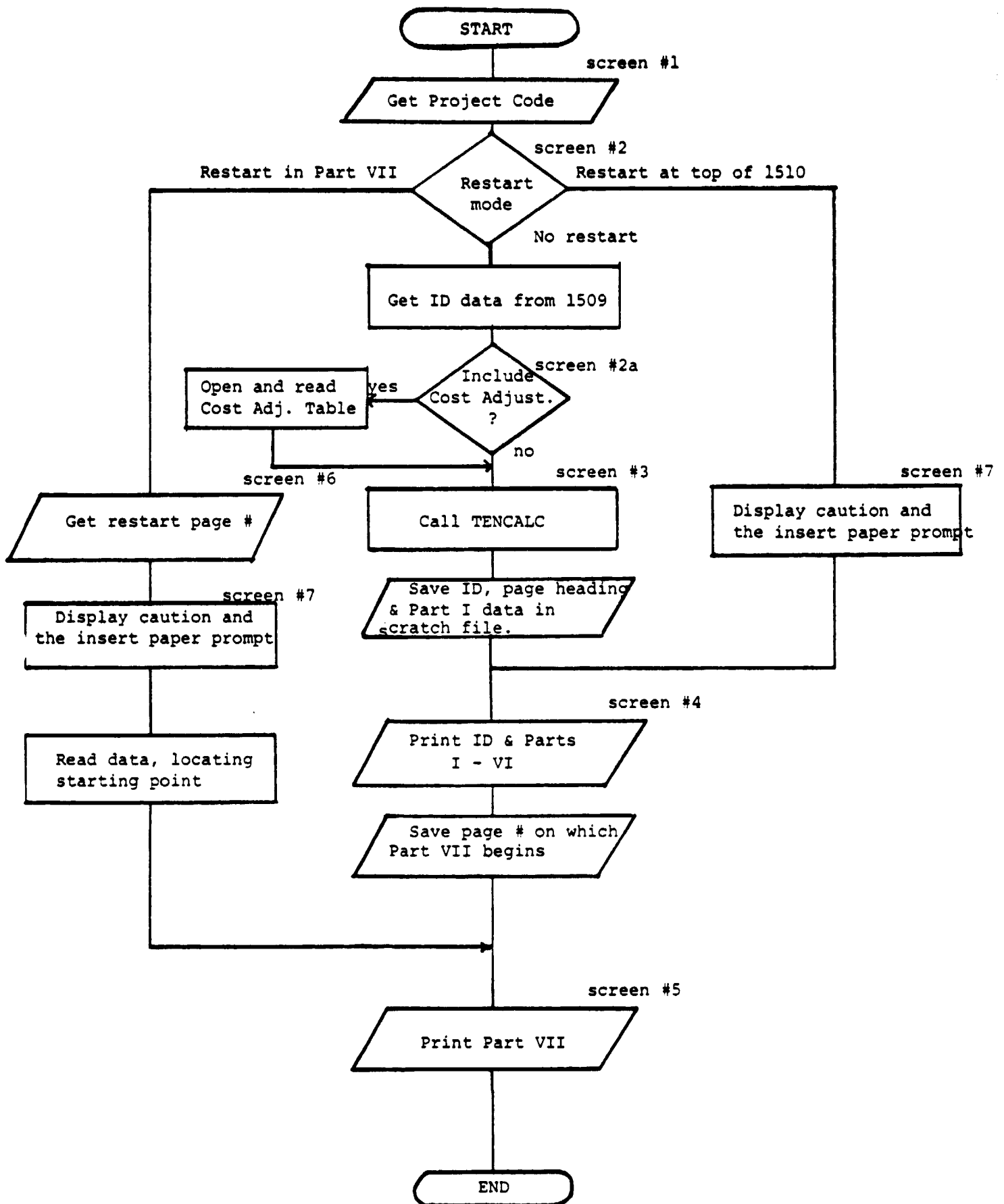
- 1) "Read Data, Locating Starting Point". The program should be designed around one of two restart methods:
 - . Character string search. This is like TYPESPEC in that the operator supplies a line item name which is to appear as the first line item on the first restart page. The program then searches for this string.
 - . Pagination. This is like Q1's TYPE. The program reads through the data as if it were printing it, making page end decisions until the desired page number is reached.

Either approach is acceptable.

The screen descriptions which follow assume the pagination approach. If the character string search is chosen, then modify Screen #6 accordingly.

- 2) "Save Page # on Which Part VII Begins". This step is needed only if the pagination method of restarting is chosen. Since Parts I-VI are variable in length, Part VII may begin on page #3, #4, or whatever. The page number of this first Part VII page must be saved if the program is to count its way to the desired restart page.

FIGURE 5-1
TENTYPE Flow



5.1 TENTYPE DISPLAY OUTPUTS

SCREEN #1: Opening Prompt

TENTYPE (Version 1.0 10/26/79)
PROJECT CODE: █

SCREEN #2: Restart Prompt

Project 81JC459	TENTYPE
RESTART	
Ø = No restart	
1 = Restart at top of 1510	
7 = Restart in Part VII	
█	

SCREEN #2a: Cost Adjustment Prompt

Project 81JC459	TENTYPE
INCLUDE COST ADJUSTMENT (Y or N)? █	

SCREEN #3: Calculating Notice

Project 81JC459	TENTYPE
CALCULATING PLEASE WAIT	

SCREEN #4: Typing Parts I-VI Notice

Project 81JC459	TENTYPE
TYPING PARTS I-VI	

SCREEN #5: Typing Part VII Notice

Project 81JC459	TENTYPE
TYPING PART VII	

SCREEN #6: Restart Page #

Project 81JC459	TENTYPE Restart
BEGIN ON PAGE #: ■	

SCREEN #7: Restart Warning

Project 81JC459	TENTYPE Restart
*** CAUTION ***	
I am using data which I calculated during the last run. If you have changed: - the 1510 data, or - the 1509 data for this project since then, you should run TENTYPE again.	
INSERT PAPER: ■	

5.2 TENTYPE PRINTER OUTPUTS

Figure 5-2 shows a NASA Form 1510 with line and column positions marked on it. All fields are filled maximally according to this key:

C = any character or blank

Z 9 \$. , - = PLI picture symbols (V is omitted.)

1. PAGE ENDS

- 1) New Pages. Start at the top of a new page for:
 - . The beginning of the 1510
 - . Part II
 - . Part VII
- 2) Part I. This may extend to a second page. If it does, end the page only after a work package and all of its subordinate major elements have been listed -- or ahead of the cost adjustment table.
- 3) Part II. Break the page before numbered line items only.
- 4) Parts III, IV and V. Keep the whole of each part on one page. Do not break between the title and the body.
- 5) Part VI. Break the page only after a paragraph end.
- 6) Part VII. End the page only where you would SKIP(2) according to the discussion of Part VII below.

2. BRACKETS

Bracketed figures represent subtotals of subordinate items. The brackets are in a fixed position -- they do not drift with the length of the number.

Do not use brackets in Part I, Summary. They would be nice, but there isn't space on the line.

3. PART II

Always print all 8 categories, even if they contain blank data. If an entire category has blank data, print three asterisks in the amount column and print the footnote as shown in the sample 1510 in Appendix A.

Likewise, always print the four subcategories of category 8.

Within categories 3-7, the data base will contain:

- . A value for the total category dollar amount
- . A title and a dollar value for each of up to 10 subcategories.

If any of the subcategories are non-blank, then ignore any entry for the total category dollar amount. Calculate this value as the sum of the subcategory dollar amounts.

Close up the text if some of the subcategories are blank. That is, print only those subcategories which contain data. Do not print blank lines. See the sample 1510.

4. PART VI

This part contains text organized within 12 categories. The data base will contain only the text, not the category titles.

Always print all of the category titles, even if there is no data. Do not print asterisks for blank entries as you did in Parts II-V above.

The data will contain no code characters.

5. PART VII

This is a dump of the detailed cost estimate data almost exactly as input. The only calculation here is the Total Engineering Cost column. It equals the Quantity times the Engineering Unit Cost.

- 1) Capitalization Rule. Ideally, the data will have been input using the capitalization scheme shown in the sample 1510. In any event, print the line item names exactly as input.

- 2) Indents and Underscores. These are as shown in Figure 5-2. Indents, underscores and capitalization all serve to identify the level of item within the 5-level hierarchy.
- 3) Line Spacing Rules.
 - . Always SKIP(2) after a work package is completed.
 - . SKIP(2) if the next item is of a higher level.
 - . Otherwise, SKIP(1).
- 4) Column Headings. These should be repeated on each page along with the page heading and the part VII title, as shown.
- 5) Location and Mid-pt of Construction. If these fields are blank for a given line item, do not include them in the printout. However:
 - . For work package line items, always print these fields as illustrated.
 - . For other line items, if one or both of the fields is non-blank, then print them on a second line as illustrated.

6. NEGATIVE NUMBERS

The only places where the data base may contain negative numbers is in Part II, numbered items 1 and 2. These should use the format P'--,---,--ZV'.

7. ROUNDING

All numbers should be rounded (5 up, 4 down) on output to the precision shown in the sample.

8. FOOTNOTE

If one of the dollar amounts in Parts II-V are blank (not zero, but blank), then print '***' where the dollar amount should be, right justified. Then put a footnote on line 61 of that page (if possible) as shown. If space doesn't permit, put the footnote on the next page. If asterisks are used on another page, no second footnote is needed.

Basically, users should not leave these items blank. The asterisks alert NASA Headquarters to those costs which proposers have either not considered or have chosen to ignore. The footnote simply makes the form self-explanatory.

FIGURE 5-2
1510 Layout

NASA Form 1510
FACILITY PROJECT COST ESTIMATE

13	29	73	87
Project Code:	99CC999 CCCCC	Date:	99/99/99
Title:	CC	Submission:	C
Project #:	9999	Revision:	9
Installation:	CCCCCCCCCCCCC	Program Ofc:	CCCCC
39			
Basis of Eng'g Cost Est:	CC		
Basic engineering cost estimate data in Part VII include escalation through: 99/99/99			

I. SUMMARY OF COST ESTIMATE

Item	Contin- gency	Unit	Quant.	Unit Cost		Total Cost	
				Eng'g	Budget	Eng'g	Budget
CCCCC(Work Package Here)CCCC	Z9	CCCC	ZZZ,ZZZ	ZZZ,ZZZ.99	ZZZ,ZZZ.99	ZZZ,ZZZ,ZZ9	ZZZ,ZZZ,ZZ9
Loc=CCC Mid-pt Constr=99/99							
Av ann. cost adj rate=Z9.9%							
SI&E Services rate= Z9.9%							
Construction Mgt rate=Z9.9%							
CCCCC(Maj. Element Here)CCCC	Z9	CCCC	ZZZ,ZZZ	ZZZ,ZZZ.99	ZZZ,ZZZ.99	ZZZ,ZZZ,ZZ9	ZZZ,ZZZ,ZZ9
CCCCC(Maj. Element Here)CCCC	Z9	CCCC	ZZZ,ZZZ	ZZZ,ZZZ.99	ZZZ,ZZZ.99	ZZZ,ZZZ,ZZ9	ZZZ,ZZZ,ZZ9
Loc=CCC Mid-pt Constr=99/99							
Av ann. cost adj rate=Z9.9%							
CCCCC(Maj. Element Here)CCCC	Z9	CCCC	ZZZ,ZZZ	ZZZ,ZZZ.99	ZZZ,ZZZ.99	ZZZ,ZZZ,ZZ9	ZZZ,ZZZ,ZZ9
CCCCC(Work Package Here)CCCC	Z9	CCCC	ZZZ,ZZZ	ZZZ,ZZZ.99	ZZZ,ZZZ.99	ZZZ,ZZZ,ZZ9	ZZZ,ZZZ,ZZ9
Loc=CCC Mid-pt Constr=99/99							
Av ann. cost adj rate=Z9.9%							
SI&E Services rate= Z9.9%	38	42	47	55	66	77	89
Construction Mgt rate=Z9.9%							

TOTAL ENGINEERING COST	\$\$\$\$, \$\$\$, \$\$\$	
Cost Adjustments	<u>ZZ,ZZZ,ZZ9</u>	
SUBTOTAL	\$\$\$\$, \$\$\$, \$\$\$	
Contingencies	ZZ,ZZZ,ZZ9	(29.9%)
Supervision, Inspection & Engineering Services	ZZ,ZZZ,ZZ9	92
Construction Management	ZZ,ZZZ,ZZ9	
Other Burden Costs	ZZ,ZZZ,ZZ9	
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	ZZ,ZZZ,ZZ9	
CCCCCCC{0-5 lines here}CCCCCCC	ZZ,ZZZ,ZZ9	
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	ZZ,ZZZ,ZZ9	
TOTAL BUDGET ESTIMATE	\$\$\$\$, \$\$\$, \$\$\$	

ANNUAL COST ADJUSTMENT RATES USED
Percentages

(Source: Table dated 08/79 prepared by the center)

Location	19CC	19CC	19CC	19CC	19CC	19CC	19CC	19CC	19CC	19CC	19CC	19CC
CCC	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9
CCC	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9

{Print 1-12 years, 1-10 locations as used in the document.}

143

13
\$ Amount

[illegible]

9	1999
9	1999
9	1999

[ZZ,ZZZ,ZZ9]
ZZ,ZZZ,ZZ9
ZZ,ZZZ,ZZ9
ZZ,ZZZ,ZZ9

[ZZ,ZZZ,ZZ9]

ZZ,ZZZ,ZZ9
ZZ,ZZZ,ZZZ
ZZ,ZZZ,ZZ9

[22,222,229]

ZZ,ZZZ,ZZ9
ZZ,ZZZ,ZZ9
ZZ,ZZZ,ZZ9

[ZZ,ZZZ,ZZ9]

ZZ,ZZZ,ZZ9
ZZ,ZZZ,ZZ9
ZZ,ZZZ,ZZ9

[ZZ,ZZZ,ZZ9]

ZZ,ZZZ,ZZ9
ZZ,ZZZ,ZZ9
ZZ,ZZZ,ZZ9

[ZZ.ZZZ.ZZ9]

22,222,229
22,222,229
22,222,229
22,222,229
22,222,229

140

71
Amount: 22,222,229

142

Amount: 22,222,229

*** No value supplied

PAGE 3
NASA Form 1510

71
Amount: 22,222,229

113

191

[illegible]

NASA Form 1510

CC

CC

CC

Submission: C

8

13 Item	46 Contin- gency	54 Unit of Measure	62 Quantity	72 Unit Cost Eng'g	85 Total Cost Eng'g
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	29	CCCC	ZZZ,ZZZ	ZZZ,ZZZ.99	[ZZZ,ZZZ,ZZ9]
Loc=CCC Mid-pt Constr=99/99					
SI&E Svcs= 29.9%=\$2,ZZZ,ZZ9					
Constr Mgt=29.9%=\$2,ZZZ,ZZ9					
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	29	CCCC	ZZZ,ZZZ	ZZZ,ZZZ.99	[ZZZ,ZZZ,ZZ9]
Loc=CCC Mid-pt Constr=99/99					
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	29	CCCC	ZZZ,ZZZ	ZZZ,ZZZ.99	[ZZZ,ZZZ,ZZ9]
Loc=CCC Mid-pt Constr=99/99					
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	29	CCCC	ZZZ,ZZZ	ZZZ,ZZZ.99	[ZZZ,ZZZ,ZZ9]
Loc=CCC Mid-pt Constr=99/99					
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	29	CCCC	ZZZ,ZZZ	ZZZ,ZZZ.99	ZZZ,ZZZ,ZZ9
Loc=CCC Mid-pt Constr=99/99					
	49	56	63	71	84

{NOTE: For the lower four levels of line item, the line "Loc=CCC Mid-pt Constr=99/99" should be printed only if both fields are non-blank for that line item.}

6. FUNCTION #3: WHATIF

WHATIF lets NASA project engineers tell how total project costs would be affected by various changes in the cost estimate details. All told, the program performs these functions. It:

- . Copies the cost estimate data concerning the project of interest. It puts these in a scratch file.
- . Automatically enters the scratch file and lets the operator make the changes he desires.
- . Generates the calculated data for the project and displays the overall project cost.

(To get this bottom line, the program must do almost all of the calculations required for a full 1510 printout.)

The program then gives the operator several options. If instructed to do so, it:

- . Copies the modified data back to the data base, replacing the original cost estimate data.
- . Prints the 1510 through Part I, Summary. This gives the engineer a fuller picture of the project cost than can be displayed. It also creates a hard copy.
- . Prints, in addition to the above, the entire Part VII, Detailed Cost Estimate, as it would appear on the 1510. This option documents all of the component costs which make up the new cost estimate. The engineer would usually not select this option because of the print time required. He would want it only when a) his changes to the cost estimate were extensive and he wanted a record of them, or b) when he was satisfied with the new project cost as finally developed and he wanted a record of its components.
- . Creates a file with a name chosen by the operator and writes the modified data to it. This would be a temporary hold file. The engineer may want to retain one WHATIF configuration while trying others. This feature lets him continue with WHATIF without losing his previous inputting.

1. GENERAL WHATIF FEATURES

- 1) Users. The program will be used by both Q1 operators and by project engineers once the operator has set up the machine -- ie., turned it on, inserted the right floppy, put paper in the printer and instructed the engineer on how to use the program.
- 2) Fast Operation. The program should be optimized for speed.
- 3) Cumulative Changes. WHATIF will probably be run several times over and over against the same project. The operator must have a choice of posting his changes to the original 1510 data (copied to the scratch file) or to the results of the previous run.
- 4) File Outputs. The operator must be able to keep the results of his WHATIF run. Two options should be offered: replace the original 1510 data with this new data, or save this new data in a file created for the purpose.

The file name must be controlled, since there promise to be so many files with names containing the project code. Put these temporary data sets in files named with the project code suffixed with a lower case letter, such as 81JC453a., 81JC453b and so on. The display should prompt for the sequence letter (a, b, c, etc.) a print the file name used.

2. WHATIF FLOW

See Figure 6-1 for a flow diagram of WHATIF.

FIGURE 6-1
WHATIF Flow

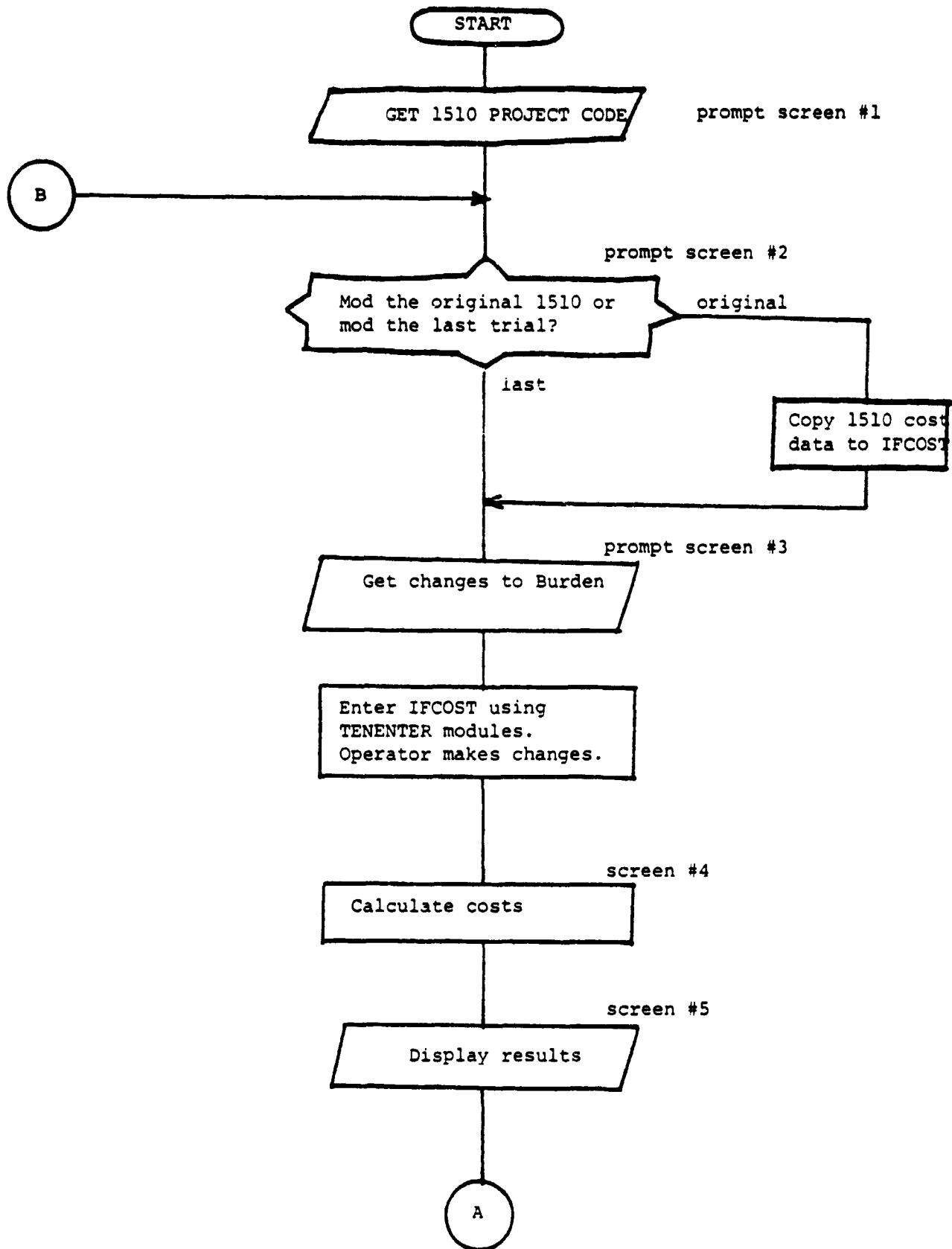
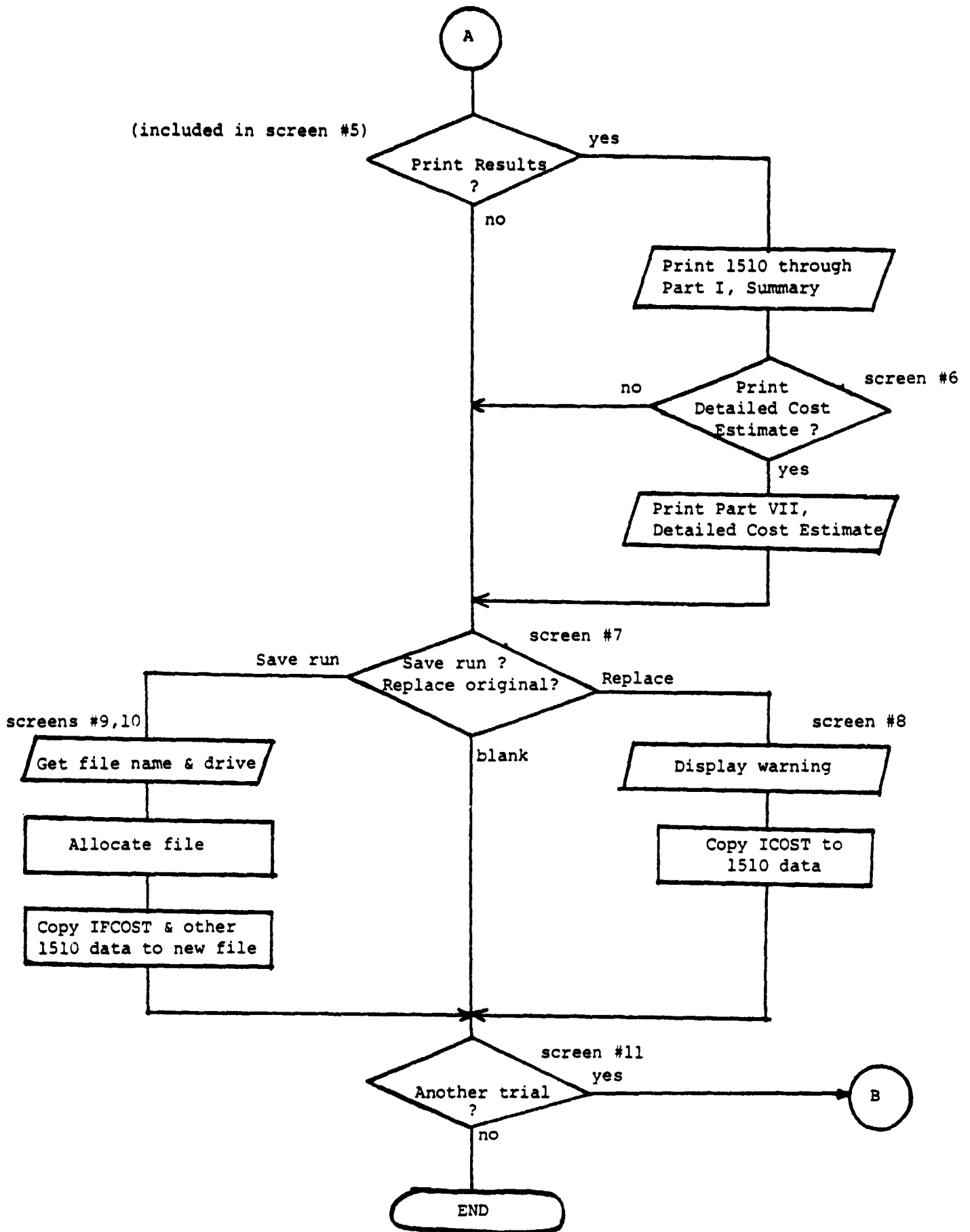


FIGURE 6-1 (Cont.)



6.1 WHATIF DISPLAY OUTPUTS

SCREEN #1 Project Code

WHATIF (Version 1.0 03/16/79) PROJECT CODE: ■

SCREEN #1a

WHATIF
I CAN'T FIND THE PROJECT YOU ASKED FOR: _____ TRY AGAIN OR PRESS THE FINISH KEY. PROJECT CODE: ■

Insert the entered value where indicated.
The FINISH key returns the Q1 to the neutral mode.

SCREEN #2 Data Source

Project 81JC459	WHATIF
WHAT DO YOU WANT TO CHANGE? 0 = A copy of the permanent 1510 9 = The results of the last WHATIF run ■	

Insert the project code where indicated.

SCREEN #2a

Project 81JC459	WHATIF
WHAT DO YOU WANT TO CHANGE?	
Ø = A copy of the permanent 1510	
9 = The results of the last WHATIF run	
x IS NOT VALID. TRY AGAIN: ■	

For x substitute the invalid entry.

SCREEN #3 SI&E and Other Burden Costs

Project 81JC459	WHATIF
MAKE CHANGES, IF ANY, & PRESS RETURN	
Other Burden Costs	Total \$99999999
→cccccccccccccccccccccccccccccccc	99999999
→cccccccccccccccccccccccccccccccc	99999999
→cccccccccccccccccccccccccccccccc	99999999
Note: If you itemize costs, do not enter a total.	

If data is to be taken from the original 1510, these values will also be from there. If data is from the last run, these values will be in memory. If data is from the last run but this is in fact the first run, the the values will be garbage. That's OK.

Display the data right justified, without commas. The dollar sign is fixed where shown.

Before proceeding, check both entries (or inherited values) for all-numeric. Convert a blank entry to a zero. Assume a decimal point after the last character entered.

SCREEN #3a

Project 91JC459	WHATIF
MAKE CHANGES, IF ANY, & PRESS RETURN	
Other Burden Costs	Total \$99999999
cccccccccccccccccccccccccccccccc	99999999
cccccccccccccccccccccccccccccccc	99999999
cccccccccccccccccccccccccccccccc	99999999
Note: If you itemize costs, do not enter a total.	
NO GOOD. ENTRY MUST BE ALL-NUMERIC, NO COMMAS.	

Cursor position as appropriate.

SCREEN #4 Calculating Notice

Project 81JC459	WHATIF
CALCULATING PLEASE WAIT	

SCREEN #5 Results

Project 81JC459	WHATIF
RESULTS	
Total Eng'g Cost	\$199,999,999
Cost Adjustments	99,999,999
S I & E Services	99,999,999
Construction Mgt	99,999,999
SUBTOTAL	\$199,999,999
Contingencies	99,999,999 (24.2%)
Other Burden Costs	99,999,999
TOTAL BUDGET ESTIMATE	\$199,999,999
PRINT RESULTS (Y or N)?	

Horn beeps when this display appears.
Format for Total Eng'g Cost, Subtotal
and Total Budget Estimate = '\$\$\$,\$\$\$,\$\$9'

Format for the contingency percentage = '29V.9'
Entry must be 'Y' or 'N'. If not, repeat screen #5.
Leave this screen displayed while typing.

SCREEN #6 Detailed Print Option

Project 81JC459	WHATIF
PRINT THE DETAILED COST ESTIMATE (Y or N)? ■	

Note: When the program has completed Part I, Summary, it should advance the paper to the top of the next page. The detailed cost estimate always begins at the top of a page.

SCREEN #7 Disposition

Project 81JC459	WHATIF
WHAT SHALL I DO WITH THIS NEW COST ESTIMATE WHICH YOU'VE MADE?	
R = Replace the existing 1510 data with this new data	
S = Save this data in a temporary file	
X = Discard it	

SCREEN #8 Warning

Project 81JC459	WHATIF
*** WARNING ***	
YOU ARE ABOUT TO ERASE THE OLD COST ESTIMATE FOR THIS PROJECT, SUBSTITUTING THIS NEW ONE.	
REPLY "YES" IF OK: █	

Any entry but 'YES' aborts the replacement.

SCREEN #9 Temporary File Name

Project 81JC459	WHATIF
YOUR TEMPORARY FILE WILL BE CALLED 81JC459* WHERE * IS A LOWER-CASE LETTER.	
ENTER A LETTER, a...z THAT YOU HAVE NOT USED BEFORE FOR THIS PROJECT: █	

Accept only lower-case letters, a to z.

SCREEN #10 Drive #

Project 81JC459	WHATIF
THANK YOU. YOUR TEMPORARY FILE WILL BE 81JC459h	
WHAT FLOPPY DISK DRIVE? █	

SCREEN #11 Rerun

Project 81JC459	WHATIF
RUN WHATIF AGAIN ON THIS PROJECT (Y or N)? ■	

6.2 WHATIF PRINTER OUTPUTS

The printer output from WHATIF is simply the first page of the 1510 plus, optionally, Part VII. All pages should bear the legend "PRELIMINARY" across the top as shown in the attached sample.

PRELIMINARY

PRELIMINARY
NASA Form 1510
FACILITY PROJECT COST ESTIMATE

PRELIMINARY

Project Code: 81JC459 81006
Title: CONSTRUCTION OF RESEARCH ANALYSIS CENTER
Project #: 5337
Installation: MAF/MSFC

Date: 02/16/79
Submission: B
Revision: 0
Program Ofc: OSTDS

Basis of Eng'g Cost Est: Preliminary Engineering Report
Basic engineering cost estimate data in Part VII include escalation through: 04/02/76

I. SUMMARY OF COST ESTIMATE

Item	Contingency	Unit	Quant.	Unit Cost		Total Cost	
				Eng'g	Budget	Eng'g	Budget
LAND ACQUISITION	2	ACRE	5	2,150.00	4,250.00	10,750	21,249
Loc=CLE Mid-pt Constr=10/80 Av ann. cost adj rate= 9.0% SI&E Services rate= 1.5% Construction Mgt rate= 0.0%							
OFFICE WING	11	SQFT	6,300	51.81	102.41	326,400	645,209
Loc=CLE Mid-pt Constr=03/81 Av ann. cost adj rate= 9.6% SI&E Services rate= 1.0% Construction Mgt rate= 6.0%							
Structural	13					11,655	23,039
Architectural	8	SQFT	6,300	28.88	57.42	181,949	361,752
Mechanical	11					37,741	74,604
Electrical	20					94,000	185,814
LABORATORY WING	6					2,547,510	5,035,771
Loc=CLE Mid-pt Constr=06/81 Av ann. cost adj rate= 9.6% SI&E Services rate= 1.0% Construction Mgt rate= 6.0%							
Structural	5					86,444	170,878
Architectural	6					1,860,458	3,677,646
Mechanical	4					600,608	1,187,247
EQUIPMENT	25					213,507	328,950
Loc=NYC Mid-pt Constr=12/80 Av ann. cost adj rate=10.3% SI&E Services rate= 5.5% Construction Mgt rate= 0.0%							
FALLOUT SHELTER	0					0	0
Loc=CLE Mid-pt Constr=04/81 Av ann. cost adj rate= 9.6% SI&E Services rate= 0.0% Construction Mgt rate= 0.0%							

PRELIMINARY
CONSTRUCTION OF RESEARCH ANALYSIS CENTER
Project code: 81JC459 Date: 02/16/79

PRELIMINARY
PAGE 2
Submission: B NASA Form 1510

TOTAL ENGINEERING COST	\$3,051,070	
Cost Adjustments	<u>2,227,281</u>	
SUBTOTAL	\$5,278,351	
Contingencies	361,424	(6.8%)
Supervision, Inspection & Engineering Services	70,313	
Construction Management	298,591	
Other Burden Costs	22,500	
Transfer Helicopter Test Pad	20,500	
Transfer Misc. Equipment	<u>2,000</u>	
TOTAL BUDGET ESTIMATE	\$6,031,179	

ANNUAL COST ADJUSTMENT RATES USED
Percentages

(Source: Table dated 08/79 prepared by the center)

Location	1976	1977	1978	1979	1980	1981
CLE	10.9	11.7	12.0	12.5	12.6	12.4
NYC	10.9	11.5	11.8	12.2	12.0	12.0

PRELIMINARY
CONSTRUCTION OF RESEARCH ANALYSIS CENTER
Project code: 81JC459

PRELIMINARY

Date: 02/16/79

Submission: B

PRELIMINARY
PAGE 3
NASA Form 1510

VII. DETAILED COST ESTIMATE

Item	Contin- gency	Unit of Measure	Quantity	Unit Cost Eng'g	Total Cost Eng'g
<u>LAND ACQUISITION</u>	2	ACRE	5	2,150.00	10,750
Loc=CLE Mid-pt Constr=10/80					
SI&E Svcs= 1.5%=\$					
Constr Mgt= %=\$	0				
<u>OFFICE WING</u>		SQFT	6,300		[326,400]
Loc=CLE Mid-pt Constr=03/81					
SI&E Svcs= %=\$ 5,157					
Constr Mgt= %=\$ 30,943					
<u>STRUCTURAL</u>	10				[11,655]
<u>Elevator Cross-Over</u>					[566]
Steel Beams		LB	800	.40	320
Galv Mtl Deck		SQFT	70	2.25	158
Conc Topping		SQFT	70	1.25	88
<u>Toilet & Corridor Areas</u>					[11,089]
Mtl Deck on Lt Ga Mtl Fram'g	14	SQFT	3,483	2.25	7,837
Allwnce for Underp'g & Lintl		EA	1	3,252.00	3,252
<u>ARCHITECTURAL</u>		SQFT	6,300		[181,949]
<u>Acoustical</u>					[20,024]
Dense Mineral Tile in Grid	3	SQFT	6,386	2.13	13,602
Glue-On Vermin-proof Tile	6	SQFT	3,015	2.13	6,422
Vermin Control Joints	5	L.F.	5,813	.73	4,243
<u>Metal Items</u>	7				[56,287]
<u>H.M. Doors & Frames</u>					[40,192]
Single		EA	42	335.00	14,070
Double		EA	11	457.00	5,027
S.S. Clad Doors	10	EA	20	998.00	19,960
Roll-up Door		EA	1	1,135.00	1,135
7' S.S. Corner Guards		EA	14	61.00	854
S.S. Bumper Rails	10	L.F.	525	6.00	3,150
6' Chain Link Fence, 3-strand					[7,324]
Wire Fencing		L.F.	457	10.67	4,876
16' x 6' Gates		EA	3	816.00	2,448
Toilet Room Lockers		EA	53	75.00	3,975
Vanities		L.F.	22	36.00	792
<u>Lathe and Plaster</u>	2	S.Y.	2,073	9.75	20,212
<u>Computer Floor in D.O.C.R.</u>	6	S.F.	341	8.00	2,728
Loc=NYC Mid-pt Constr=12/80					
<u>Finish Hardware</u>	10				[3,545]
Kick Plates		EA	21	21.94	461
Door Closers		EA	46	67.05	3,084

7. FUNCTION #4: DATA BASE MANIPULATIONS

Since data base design is left to PRC, so is the design of the programs to manipulate the data base. However, these requirements must be met:

1. BACKUP

Operators must be able to make backups of the data base, both:

- . As a whole, and
- . Regarding the single 1510 which they may be in the midst of inputting.

2. 1510 DELETIONS

The operator must be able to delete named projects from the data base.

3. EXTRACTIONS

The operator must be able to extract named 1510's from the data base. These might then be placed on a floppy disk for mailing or put in a secondary data base for storage. This latter would happen if a project were dropped from this year's budget but the center felt that it might be included in some future year's budget.

4. MERGE

At Headquarters, a floppy disk may arrive containing 1510's for 20 projects -- some of them new, some of them reworks of previously-submitted projects. The Headquarters operator must be able to merge this floppy into the existing data base, replacing superseded 1510's and creating new entries as appropriate. The operator should be able to do this merging at one pass, with all file allocations, copies, identification of new vs. old -- all of those actions done automatically by the Q1.

5. MERGE WHATIF TEMPORARY FILES

WHATIF provides for storing on a floppy disk the results of a WHATIF run. Typically, the project engineer will have several WHATIF runs, all of which meet the budget goal, but by different methods. Once a decision is made as to which design to take, the Q1 operator may be asked to replace the old 1510 data with the data in one of the temporary files. This must be possible.

The WHATIF spec suggests that the WHATIF temporary data be put on a floppy disk with one file per run. This is not required. Any other arrangement for handling this data is acceptable.

APPENDIX A

SAMPLE NASA Form 1510 PRINTOUT

NASA Form 1510
FACILITY PROJECT COST ESTIMATE

Project Code: 81JC459 81006
Title: CONSTRUCTION OF RESEARCH ANALYSIS CENTER
Project #: 5337
Installation: MAF/MSFC

Date: 02/16/79
Submission: B
Revision: 0
Program Ofc: OSTDS

Basis of Eng'g Cost Est: Preliminary Engineering Report
Basic engineering cost estimate data in Part VII include escalation through: 04/02/76

I. SUMMARY OF COST ESTIMATE

Item	Contin- gency Unit	Quant.	Unit Cost		Total Cost	
			Eng'g	Budget	Eng'g	Budget
LAND ACQUISITION	2 ACRE	5	2,150.00	4,250.00	10,750	21,249
Loc=CLE Mid-pt Constr=10/80 Av ann. cost adj rate= 9.0% SI&E Services rate= 1.5% (4) Construction Mgt rate= 0.0%						
OFFICE WING	11 SQFT	6,300	51.81 (3)	102.41	326,400	645,209
Loc=CLE Mid-pt Constr=03/81 Av ann. cost adj rate= 9.6% SI&E Services rate= 1.0% Construction Mgt rate= 6.0%						
Structural	13 (4)				11,655	23,039
Architectural	8 SQFT	6,300	28.88	57.42	181,949	361,752
Mechanical	11				37,741	74,604
Electrical	20				94,000	185,814
LABORATORY WING	6				2,547,510	5,035,771
Loc=CLE Mid-pt Constr=06/81 Av ann. cost adj rate= 9.6% SI&E Services rate= 1.0% Construction Mgt rate= 6.0%						
Structural	5				86,444	170,878
Architectural	6				1,860,458	3,677,646
Mechanical	4				600,608	1,187,247
EQUIPMENT	25				213,507	328,950
Loc=NYC Mid-pt Constr=12/80 Av ann. cost adj rate=10.3% SI&E Services rate= 5.5% Construction Mgt rate= 0.0%						
FALLOUT SHELTER	0				0	0
Loc=CLE Mid-pt Constr=04/81 Av ann. cost adj rate= 9.6% SI&E Services rate= 0.0% Construction Mgt rate= 0.0%						

TOTAL ENGINEERING COST	\$3,051,070	
Cost Adjustments	<u>2,227,281</u>	
SUBTOTAL	\$5,278,351	
Contingencies	361,424	(6.8%)
Supervision, Inspection & Engineering Services	70,313	
Construction Management	298,591	
Other Burden Costs	22,500	
Transfer Helicopter Test Pad	20,500	
Transfer Misc. Equipment	<u>2,000</u>	
TOTAL BUDGET ESTIMATE	\$6,031,179	

ANNUAL COST ADJUSTMENT RATES USED
Percentages

(Source: Table dated 08/79 prepared by the center)

Location	1976	1977	1978	1979	1980	1981
CLE	10.9	11.7	12.0	12.5	12.6	12.4
NYC	10.9	11.5	11.8	12.2	12.0	12.0

II. RELATED COSTS

	<u>Manyears</u>	<u>\$ Amount</u>
1. Annual Operations & Maintenance Cost, excluding energy	-3	-108,000
2. Annual Energy Cost		-16,000
3. Purchases of Noncollateral Eqpt	<u>Fund Source</u> <u>Year</u>	
Precision Framistan	6 196	[106,500]
Plug for Precision Framistan	6 1976	106,498
		2
4. Transfer as Excess, Collateral Eqpt (Include transfer costs in project cost estimate)		[129,500]
Helicopter Test Pad		115,000
Miscellaneous Equipment		14,500
5. Transfer as Excess, Noncollateral Eqpt		*** (P)
6. Existing Collateral Eqpt		[99,999,999]
Spare Fuses		49,974,379
Spare Floppy Disks		49,999,991
Spare Q1's		16
Certified Gizmos		19,613
Mixed Gizmos & Lemons		6,000
7. Existing Noncollateral Eqpt		0
8. Design Costs		[88,000]
Conceptual Study Funded by R&D		0
Special Studies		0
PER		0
Design		88,000

III. FUTURE FUNDING PLAN

Fiscal Year: 1984	Amount: 654,321
-------------------	-----------------

IV. ACTIVATION COSTS

Amount: 99,999,999

V. OTHER COSTS

Amount: 99,999,999

*** No value supplied



VI. NOTICES

ENERGY/NATURAL RESOURCES: The scope of this project involves no substantial change in commitment of energy or natural resources.

ENVIRONMENTAL STATEMENT: This work is normal for the ongoing activities of JSC and is generally covered by the Institutional Environmental Impact Statement for the center, published in 1971. The scope of this project involves no additional significant environmental impact.

FLOODPLAIN: This facility does not involve floodplains. E.O. #11988 has been followed.

AIR & WATER POLLUTION CONTROL: This facility cost estimate includes funds for a water treatment system for wastes from the laboratory. The project complies with OMB Circular A-106 and E.O. #11752.

RANDOLPH-SHEPPARD ACT: The scope of this project does not provide for a permanent material change in the floor area of any building. Consequently, the consideration of vending facilities for the blind as required by the Randolph-Sheppard Act amendments of 1974 (Public Law 93-516) is not applicable to this project.

PHYSICALLY HANDICAPPED: Provision for access by handicapped persons will be provided consistent with P.L. 90-480.

OCCUPATIONAL SAFETY: This facility cost estimate includes amounts required to ensure safe and healthful work places for Federal employees consistent with the Occupational Safety and Health Act of 1970, E.O. #11807, and provisions of the Department of Labor.

STATE & LOCAL COORDINATION: This facility will not have a significant impact on the local area; OMB Circular A-95 does not apply.

AUTOMATIC DATA PROCESSING EQUIPMENT: This facility project includes no funds for the acquisition of ADP equipment. The ADP acquisition policies of GSA Federal Management Circular 74-5 do not apply.

UNFORSEEN PROGRAMMATIC NEEDS: This facility is not proposed due to an unforeseen programmatic need.

ENDANGERED SPECIES:

HISTORICAL PRESERVATION:

VII. DETAILED COST ESTIMATE

Item	Contin- gency	Unit of Measure	Quantity	Unit Cost Eng's	Total Cost Eng's
<u>LAND ACQUISITION</u>	2	ACRE	5	2,150.00	10,750 (2)
Loc=CLE Mid-pt Constr=10/80					
SI&E Svcs= 1.5%=\$	(12)				
Constr Mgt= %=\$	0				
<u>OFFICE WING</u>	(13)	SQFT	6,300		[326,400] (10)
Loc=CLE Mid-pt Constr .03/81					
SI&E Svcs= %=\$ 5,157					
Constr Mgt= %=\$ 30,943	(2)				
<u>STRUCTURAL</u>	10				[11,655]
<u>Elevator Cross-Over</u>					[566]
Steel Beams		LB	800	.40	320
Galv Mtl Deck		SQFT	70	2.25	158
Conc Topping		SQFT	70	1.25	88
<u>Toilet & Corridor Areas</u>					[11,089]
Mtl Deck on Lt Ga Mtl Fram'g	14	SQFT	3,483	2.25	7,837
Allwnce for Underp'g & Lintl		EA	1	3,252.00	3,252
<u>ARCHITECTURAL</u>		SQFT	6,300		[181,949]
<u>Acoustical</u>					[20,024]
Dense Mineral Tile in Grid	3	SQFT	6,386	2.13	13,602
Glue-On Vermin-proof Tile	6	SQFT	3,015	2.13	6,422 (11)
Vermin Control Joints	5	L.F.	5,813	.73	4,243
<u>Metal Items</u>	7				[56,287]
H.M. Doors & Frames					[40,192]
Single		EA	42	335.00	14,070
Double		EA	11	457.00	5,027
S.S. Clad Doors	10	EA	20	998.00	19,960
Roll-up Door		EA	1	1,135.00	1,135
7' S.S. Corner Guards		EA	14	61.00	854
S.S. Bumper Rails	10	L.F.	525	6.00	3,150
6' Chain Link Fence, 3-strand					[7,324]
Wire Fencing		L.F.	457	10.67	4,876
16' x 6' Gates		EA	3	816.00	2,448
Toilet Room Lockers		EA	53	75.00	3,975
Vanities		L.F.	22	36.00	792
<u>Lathe and Plaster</u>	2	S.Y.	2,073	9.75	20,212
<u>Computer Floor in D.O.C.R.</u>	6	S.F.	341	8.00	2,728 (14)
Loc=NYC Mid-pt Constr=12/80					
<u>Finish Hardware</u>	10				[3,545]
Kick Plates		EA	21	21.94	461
Door Closers		EA	46	67.05	3,084

DETAILED COST ESTIMATE (Continued)

<u>Item</u>	<u>Contin-</u> <u>gency</u>	<u>Unit of</u> <u>Measure</u>	<u>Quantity</u>	<u>Unit Cost</u> <u>Eng's</u>	<u>Total Cost</u> <u>Eng's</u>
<u>Floor Finishes</u>	4				[28,761]
Concrete Sealer		S.F.	1,247	.31	13,602
Dex-O-Tex		S.F.	10,166	2.44	24,805
4" Cove Base		L.F.	1,592	1.47	2,340
Carpet		S.Y.	63	19.50	1,229
<u>Maintenance & Repair</u>	3				[837]
Adjust Hangar Doors		MH	16	13.00	208
Check O.H. Crane		MH	8	13.10	129
Replacement Parts	20	Lot	1	500.00	500

{Etcetera through end of the detailed cost estimate data.}

NOTES

- 1 and 2 Contingencies. Compare the summary value for Contingency with the value in Part VII:

- . The contingency for STRUCTURAL was input as 10. It appears as 10 in Part VII.
- . The figure 13 in the summary reflects the weighted contingency % for the whole major element STRUCTURAL. Part VII shows that one of the subordinate elements to STRUCTURAL has a contingency % of 14. That element is also very large in dollar terms. The weighted average contingency % for STRUCTURAL turns out to be 12.6, which is rounded to 13, the value that appears in the summary.

In the summary calculations, the items which contain no value for contingency % are given the value of the next higher level element. Thus the contingency for "16' x 6' Gates" is 7.

3. Calculated Unit Costs. Unit costs were calculated for these line items because the input data (see Part VII) contained a value for Quantity.
4. SI&E Services Rate. This data element and the Construction Management data element can be input as either a percentage or as a dollar amount. If a dollar amount, the program calculates the percentage and prints it in the summary.
5. Other Burden Costs. There may be from 0 to 3 items under Other Burden Costs. The line "Other Burden Costs" is always printed. It may have a dollar value even if there are no named sub-items.
6. The cost adjustment listing simply shows the values that are in the Cost Adjustment Table. The years shown are only those years that are used in this 1510 (up to 12 years). The span of years printed covers all locations used in the 1510. Thus, the 1981 rate for NYC is printed even though that value is never used in this 1510.

NOTES (Continued)

7. Footnote. This footnote should be printed whenever blank cost data is supplied for Parts II through V. It (and the asterisks in the line) alerts the reader that the person who supplied the 1510 ignored these line items.
8. Page Breaks. In the sample, Part VI starts at the top of a new page. This is coincidental. Begin a new page only for Parts I, II and VII.
9. Brackets. No brackets appear around the Total Engineering Cost in this line because there are no subordinate lines to this item.
10. Blank Unit Cost. No unit cost is calculated in Part VII.
11. Rounding. All calculated values on the 1510 are rounded, five up, four down.
12. Dollar Sign. Here, print the dollar sign even if no value was entered. The dollar sign is thus not part of the picture specification.
- 13,14. Location and Mid-Pt of Construction. Print these fields for each work package. Also print them for those line items in which one or both of them are non-blank.

Note: This rule applies in Part I as well as Part VII.

APPENDIX B
1510 DATA DICTIONARY

<u>DATA ELEMENT</u>	<u>SOURCE</u>	<u>INTERNAL FORMAT</u>	<u>OUTPUT FORMAT</u>	<u>REMARKS</u>
<u>Identification</u>				
Project Code	Operator	99CC999	99CC999	
Local Project Code	1509	5 ch	5 ch	
Title	1509	43 ch	43 ch	All caps usual
Project #	1509	4 ch	4 ch	
Installation	1509	12 ch	12 ch	
1509/1510 Date	1509	8 ch	8 ch	MM/DD/YY customary
Submission	1509	1 ch	1 ch	Letter is usual
Revision	1509	1 ch	1 ch	Number is usual
Program Office	1509	5 ch	5 ch	
Basis of Eng'g Cost Est	Operator	57 ch	57 ch	Init caps usual
Escalation Date	Operator	8 ch	8 ch	MM/DD/YY required
<u>Data in Cost Estimate Lines</u>				
Item Name	Operator	28 ch	28 ch	In Part VII, work pkg & maj element item names should be converted to all caps on output.
Contingency %	Operator/ calculated	F(2)	'Z9'	
Unit of Measure	Operator	4 ch	4 ch	Any capitalization
Quantity	Operator	F(6)	'ZZZ,ZZZ'	
Eng'g Unit Cost	Op/cal	F(7,2)	'ZZ,ZZZV.99'	
Budget Unit Cost	Calculated	F(7,2)	'ZZ,ZZZV.99'	
Location	Operator	3 ch	3 ch	Usually all caps
Mid-point Construction	Operator	99/99	99/99	Calculations are done on this item.

APP B (2)

<u>DATA ELEMENT</u>	<u>SOURCE</u>	<u>INTERNAL FORMAT</u>	<u>OUTPUT FORMAT</u>	<u>REMARKS</u>
Total Eng'g Cost	Calculated	F(9)	'ZZZ,ZZZ,ZZ9'	
Total Budget Cost	Calculated	F(9)	'ZZZ,ZZZ,ZZ9'	

Additional Data for Work Package Line Items

Average Annual Cost Adjustment Rate	Calculated	F(3,1)	'Z9.9'%	
SI&E Services Rate	Operator/ calculated	F(3,1)	'Z9.9'	If not input, then calculate.
SI&E Services Amount	Operator	F(8)	'ZZ,ZZZ,ZZ9'	Either this or the SI&E Svcs Rate is input.
Construction Management Rate	Operator/ calculated	F(3,1)	'Z9.9'	If not input, then calculate.
Construction Management Amount	Operator	F(8)	'ZZ,ZZZ,ZZ9'	Either this or the Constr Mgt Rate is input.

Bottom Line Data

Total Engineering Cost	Calculated	F(9)	'\$\$\$\$,\$\$\$,\$\$9'	
Cost Adjustments	Calculated	F(8)	'Z: ,ZZZ,ZZ9'	
SI&E Services	Calculated	F(8)	'ZZ,ZZZ,ZZ9'	
Construction Management	Calculated	F(8)	'ZZ,ZZZ,ZZ9'	
Subtotal	Calculated	F(9)	'\$\$\$\$,\$\$\$,\$\$9'	
Contingencies	Calculated	F(8)	'ZZ,ZZZ,ZZ9'	
Overall Contingency %	Calculated	F(3,1)	('Z9.9'%)	
Other Burden Costs	Operator/ calculated	F(8)	'ZZ,ZZZ,ZZ9'	Subordinate items summed, if any.
OBC Item Name	Operator	28 ch	28 ch	
OBC Item Amount	Operator	F(8)	'ZZ,ZZZ,ZZ9'	
Total Budget Estimate	Calculated	F(9)	'\$\$\$\$,\$\$\$,\$\$9'	

<u>DATA ELEMENT</u>	<u>SOURCE</u>	<u>INTERNAL FORMAT</u>	<u>OUTPUT FORMAT</u>	<u>REMARKS</u>
<u>Data in Part II, "Related Costs"</u>				
O&M Manyears	Operator	99, signed	'--9'	No calculations are done on this.
O&M Amount	Operator	F(7), signed	'---,---,--9'	No calculations are done on this. See Note 1.
Annual Energy Cost	Operator	F(7)	'---,---,--9'	"
Line 3-7 Item Name	Operator	28 ch	28 ch	
Fund Source	Operator	1 ch	1 ch	Usually a number
Fund Source Year	Operator	2 ch	19'99'	
Line 3-8 Item Cost	Operator/ calculated	F(8)	'ZZ,ZZZ,ZZ9'	See Note 1
Line 3-8 Line Total	Operator/ calculated	F(8)	'ZZ,ZZZ,ZZ9'	See Note 1
<u>Data in Parts III through VI</u>				
Parts III-V Cost	Operator	F(8)	'ZZ,ZZZ,ZZ9'	No calculations are done on these. See Note 1
Part III Fiscal Year	Operator	2 ch	19'99'	
Notices Text Items	Operator	329 ch less title 3,634 ch for all ten items, not including titles.	Text	Each of the 12 items is 329 ch long including the item title. Since the title is not part of the data, the actual amount of data varies between the items.

NOTE

1. If these values are blank, as distinct from zero, then:
 - a) Output '***', right justified in the column, and
 - b) Output a footnote at the bottom of the page. See the sample 1510 in Appendix A

APPENDIX C

GENERATING THE CALCULATED VALUES -- TENCALC

The subprogram TENCALC returns the data necessary for the Q1 to print Part I of the 1510. Both TENTYPE and WHATIF use it.

1. INPUTS

1) Passed from the Calling Program

- . Project code
- . Supervision, Inspection & Engineering Services amount
- . Other Burden Costs
- . Escalation Date
- . Construction Start Date, Construction Completion Date from the 1509 data for this project.

2) File Inputs

- . The detailed cost estimate data for this project
- . The cost adjustment table for this center.

2. OUTPUTS

Either:

- 1) A print file containing Part I of the 1510, or
- 2) Internal variables from which the calling program can print Part I of the 1510.

PRC should decide which format makes the most sense.

3. VOLUME

Part I of the 1510 lists data for the whole project, every work package, and every major element. It may be assumed that the 1510 has no more than these maxima:

- . 10 work packages
- . 40 major elements, total

If the detailed cost data exceeds these limits, then TENCALC (or the calling program) should recognize that fact, both display and print an error message describing the limit exceeded, and stop.

4. OVERVIEW

Look at Part I of the 1510 shown in Appendix A.

The data base contains the Quantity and Engineering Unit Cost values. These are multiplied to get the values in the Total Engineering Cost column. These are summed to yield the Total Engineering Cost value at the bottom of the page.

A number of items are then added to the Total Engineering Cost to yield the Total Budget Estimate for the project as a whole. This is the very bottom line of the page.

This Total Budget Estimate is then pro-rated back over each of the individual line items in Part I as the Total Budget Cost of each line item. If you were to add up all of the values in the Total Budget Cost column, they would yield the Total Budget Estimate, the very bottom line.

The Total Budget Cost for each line item is then divided by the Quantity to yield the Budget Unit Cost for that line item.

5. FLOW

Figure C-1 illustrates this flow. The individual steps are detailed below.

FIGURE C-1
TENCLAC Flow

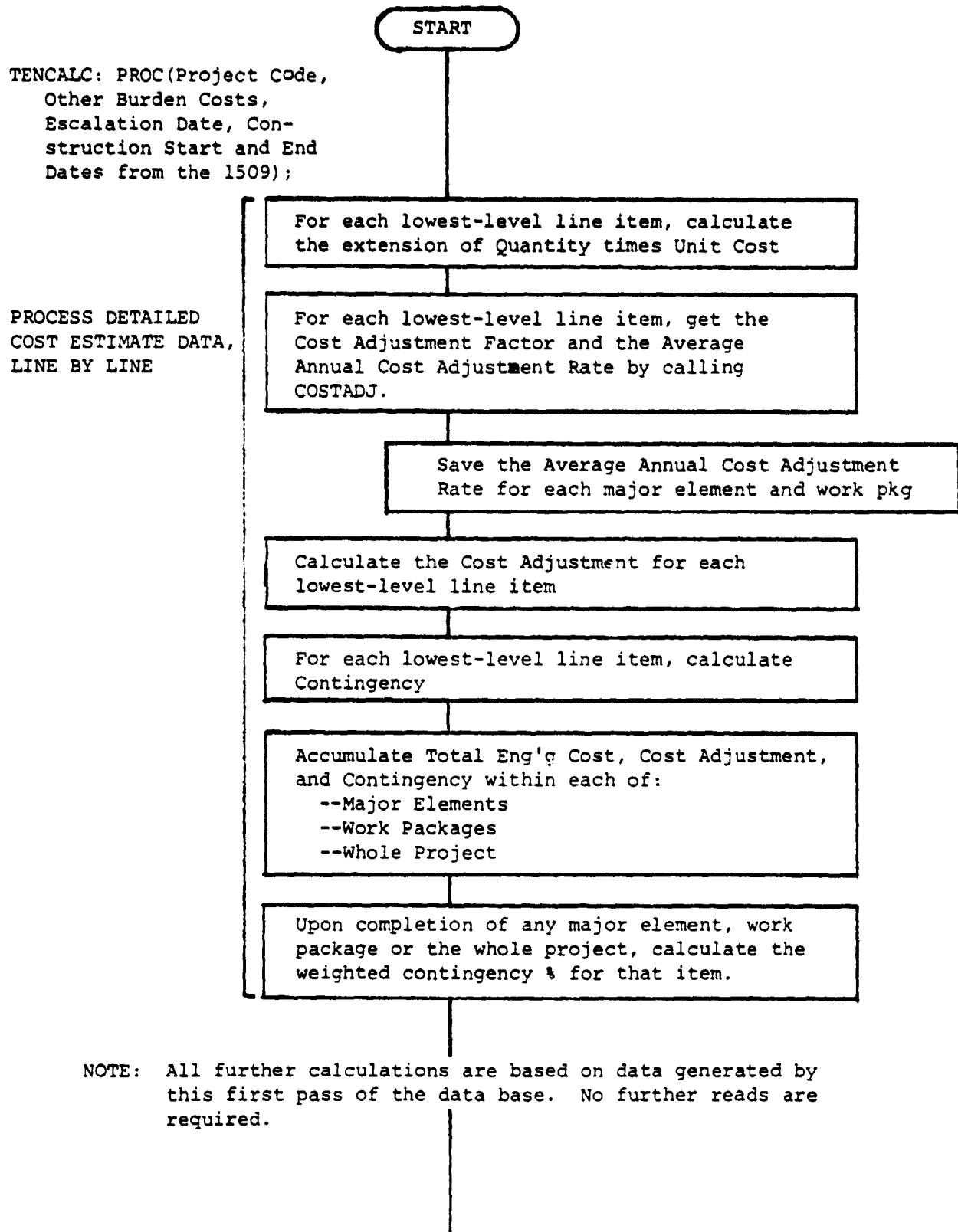


FIGURE C-1
(Continued)

PROCESS SUMMARY DATA

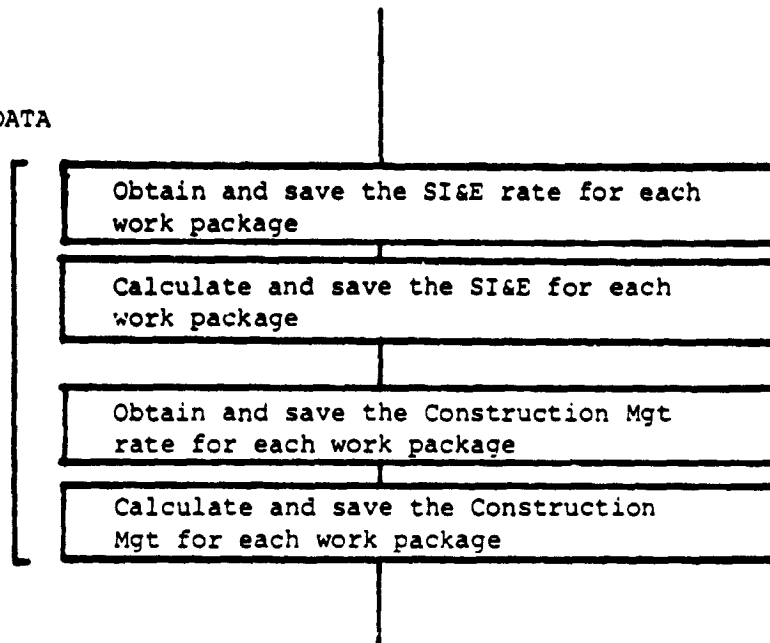


FIGURE C-1
(Concluded)

CALCULATE OVERALL
PROJECT TOTALS
AND RATES

Accumulate, separately
SI&E and Construction
Management for the whole project

Calculate Subtotal, Overall Contingency,
and Overall Contingency %

Save for Summary Output Data

Sum the Other Burden Cost items and
calculate the Overall Burden Rate

Calculate the Total Budget Estimate

Save for Summary Output Data

CALCULATE BUDGET
VALUES FOR EACH
LINE OF THE
SUMMARY DATA,
LINE BY LINE

Calculate Total Budget Cost (item)

Save for Summary Output Data

Calculate Unit Budget Cost back extensions
where indicated

Save for Summary Output Data

Calculate Unit Engineering Cost back
extensions where indicated

Save for Summary Output Data

Return Summary Output Data (as variables
or as a file)

6. PROCESS DETAILED COST ESTIMATE DATA

This first step extracts the data necessary for Part I of the 1510 from the detailed cost estimate data in Part VII. After this step, no further reads of the data base are required.

Recall that the detailed cost estimate data contains one line item for every line in Part VII of the 1510. Some of these line items are lowest-level lines; they contain all of the basic cost information:

- . Quantity
- . Unit Cost
- . Contingency %
- . Cost Adjustment Data (Location and Mid-pt of Construction date)

Other line items are summary lines -- they do not contain a full set of cost information. Rather, their information must be calculated from the data in their subordinate line items. This first step does that.

You will be filling in the following structure for every work package and major element:

- 1 Work Package/Major Element
 - 2 Raw Data
 - 3 Work Package vs. Major Element indicator
 - 3 Item name*
 - 3 Unit of Measure*
 - 3 Quantity*
 - 3 Engineering Unit Cost*
 - 3 Location*
 - 3 Mid-point of Construction*
 - 2 Calculated Data
 - 3 Total Engineering Cost*
 - 3 Average Annual Cost Adjustment Rate*
 - 3 Cost Adjustment
 - 3 Contingency
 - 3 Weighted Contingency %

*These items appear on the printed 1510. All of the other items are intermediate products, discarded at the end of TENCALC.

1) Extensions

Within each lowest-level line item, extend the Quantity and Unit Cost to yield the Total Engineering Cost:

$$\text{Quantity} \times \text{Engineering Unit Cost} = \text{Total Eng'g Cost}_{(\text{item})}$$

2) Cost Adjustment Factor and Average Annual Cost Adjustment Rate

Obtain both items by calling the subprogram COSTADJ as described in Appendix D.

If the line item is a work package or major element, then save the Average Annual Cost Adjustment Rate. Otherwise, discard this item.

IMPORTANT NOTE: Very few line items will require that COSTADJ be called. Most line items will contain blank data for Location and Mid-pt Construction. In those cases, use cost adjustment factor from the next higher level and do not call COSTADJ. The effect of this procedure is to let the engineer specify the cost adjustment basis for an entire group of items without having to repeat it for each one individually. Where cost adjustment data are specified (Location and Mid-pt Construction), they should be used.

3) Cost Adjustment

The cost adjustment is a dollar amount. It is the amount by which Total Engineering Cost must be increased due to all of the annual cost adjustments (ie., inflation adjustments) between the completion date which was built into the basic estimates and the completion date that is now expected.

$$\text{Cost Adjustment}_{(\text{item})} = \text{Cost Adjustment Factor}_{(\text{item})}$$

$$\times \text{Total Engineering Cost}_{(\text{item})}$$

4) Contingencies

For each lowest-level line item, calculate the Contingency:

$$\text{Contingency}_{(\text{item})} = \frac{\left[\text{Total Eng'g Cost}_{(\text{item})} + \text{Cost Adjustment}_{(\text{item})} \right] \times \text{Contingency \%}_{(\text{item})}}{100}$$

Note: Not every lowest-level line item will contain a value for Contingency %. In those cases, use the Contingency% value in the next highest-level line item. If that, too, is blank, refer to the next highest-level line item, etc. If even the work package is blank, then assume zero for the Contingency %.

The effect of this procedure is to let the engineer specify one contingency % for an entire group of items without having to repeat it for each one individually. Where a contingency % is specified, it prevails.

5) Subtotals and Total

Accumulate and save the Total Engineering Cost, Cost Adjustment, and Contingency for:

- . Every major element
- . Every work package
- . The whole project.

6) Weighted Contingency Percentage

For every major element, work package, and for the whole project, calculate the Weighted Contingency %:

$$\text{Weighted Contingency \%}_{(\text{item})} = 100 \times \left(\frac{\text{Contingency}_{(\text{item})}}{\text{Total Eng'g Cost}_{(\text{item})} + \text{Cost Adjustment}_{(\text{item})}} \right)$$

7. PROCESS SUMMARY DATA: WORK PACKAGES & MAJOR ELEMENTS

From here on out, the calculations concern only those line items which will appear in Part I, ie., the work packages and major elements, not all of the detailed lines.

In this step, do the calculations which pertain to each work package and major element. For each work package and major element, you will be filling the following structure:

- 1 Data
 - 2 SI&E Rate*
 - 2 SI&E (a \$ amount)
 - 2 Construction Management Rate*
 - 2 Construction Management (a \$ amount)

*These two items appear on the printed 1510. All of the other items are intermediate products, discarded at the end of TENCALC.

1) SI&E Rate

Each work package line item (work packages only) in the data base will contain either a dollar amount or a percentage for SI&E Services. If the percentage is supplied, divide it by 100 to yield the rate. Otherwise:

$$\text{SI\&E Rate} = \frac{\text{SI\&E}}{X}$$

where X = Total Engineering Cost (work package)
 + Cost Adjustment (work package)
 + Contingency (work package)

Assign this SI&E rate to all major elements within the work package.

2) SI&E

Calculate the dollar amount of SI&E for every work package and major element:

$$\text{SI\&E}_{(\text{item})} = \left(\text{SI\&E Rate}_{(\text{item})} \right) \times \left(\text{Total Eng'g Cost}_{(\text{item})} + \text{Cost Adjustment}_{(\text{item})} + \text{Contingency}_{(\text{item})} \right)$$

3) Construction Management Rate

Construction Management is handled exactly like SI&E:

$$\text{Construction Mgt Rate} = \frac{\text{Construction Management } \%}{100}$$

$$\text{or, Construction Mgt Rate} = \frac{\text{Construction Management}}{X}$$

$$\begin{aligned} \text{where } X = & \text{Total Eng'g Cost}_{(\text{work package})} \\ & + \text{Cost Adjustment}_{(\text{work package})} \\ & + \text{Contingency}_{(\text{work package})} \end{aligned}$$

Assign this Construction Mgt Rate to all major elements within the work package.

4) Construction Management

Handle this exactly like SI&E, substituting Construction Management Rate_(item) for SI&E_(item).

8. PROJECT TOTALS AND RATES

You are now in a position to sum up so as to yield the data which appears at the bottom of Part I.

1) Get SI&E and Construction Management for the Whole Project

You have already added up the total Engineering Cost, Cost Adjustment and Contingency for the project. Now do the same for SI&E and Construction Management. Save the results for output.

2) Calculate the Subtotal

$$\begin{aligned} \text{Subtotal} &= \text{Total Engineering Cost}_{(\text{project})} \\ &\quad + \text{Cost Adjustment}_{(\text{project})} \end{aligned}$$

Save the Subtotal for output.

3) Calculate Overall Contingency %

$$\text{Overall Contingency \%} = \left(\frac{\text{Contingency}_{(\text{project})}}{\text{Subtotal}} \right) \times 100$$

4) Calculate Other Burden Costs

The data may contain up to five Other Burden Cost items. If so, add up their dollar amounts to yield the total Other Burden Cost. Save this for output.

If all of the items are blank, use the amount entered directly as the Total Other Burden Cost.

If you have both subordinate items and a total amount, then disregard the total.

5) Calculate the Burden Rate

$$\text{Burden Rate} = \frac{\text{Other Burden Costs}}{Y}$$

where $Y = \text{Subtotal} + \text{Contingency}_{(\text{project})}$

+ $\text{SI\&E}_{(\text{project})}$ + $\text{Construction Mgt}_{(\text{project})}$

6) Calculate the Total Budget Estimate

This is the bottom line of the 1510. Save it for output.

Total Budget Estimate =

Subtotal + $\text{Contingency}_{(\text{project})}$

+ $\text{SI\&E}_{(\text{project})}$ + $\text{Construction Mgt}_{(\text{project})}$

+ Other Burden Costs

9. GET BUDGET VALUES: WORK PACKAGES & MAJOR ELEMENTS

Go back now over the summary data, applying the various rates and quantities to each line item in turn. For each line item, work package or major element, do the following:

1) Calculate Total Budget Cost_(item)

$$\begin{aligned}
 &\text{Total Budget Cost}_{(item)} \\
 &= \left[\text{Total Eng'g Cost}_{(item)} + \text{Cost Adjustment}_{(item)} \right. \\
 &\quad + \text{SI\&E}_{(item)} \\
 &\quad + \text{Construction Management}_{(item)} \\
 &\quad \left. + \text{Contingency}_{(item)} \right] \\
 &\quad \times \left[1 + \text{Burden Rate} \right]
 \end{aligned}$$

Save the results for output.

2) Calculate Back Extension, Engineering Unit Cost

In some cases, the program must calculate the Engineering Unit Cost based on the Total Engineering Cost:

$$\text{Engineering Unit Cost}_{(item)} = \frac{\text{Total Engineering Cost}_{(item)}}{\text{Quantity}_{(item)}}$$

Make this calculation if:

- . The line item has a blank Engineering Unit Cost, and
- . The line item has a non-blank value for Quantity.

If both Quantity and Engineering Unit Cost are blank for this item, then ignore this calculation.

3) Calculate Back Extension, Budget Unit Cost

This works the same way as the previous step.
As there, only some line items are affected.

$$\text{Budget Unit Cost}_{(\text{item})} = \frac{\text{Total Budget Cost}_{(\text{item})}}{\text{Quantity}_{\text{item}}}$$

Make this calculation only if:

- . The line has a blank Budget Unit Cost, and
- . The line item has a non-blank value for Quantity.

10. BLANK DATA

If a numeric field in the data is blank, assume that it equals zero.

Exceptions are the dates (See Appendix D) and Quantity as follows:

- . Do not transform a blank Quantity into a zero Quantity when printing the Quantity column of Part I.
- . Do not transform a blank Quantity into a zero Quantity so as to confuse the back extension test just mentioned.

11. ZERODIVIDE

Take care that the program does not fail on a ZERODIVIDE error.

APPENDIX D

CALCULATING COST ADJUSTMENT -- COSTADJ

This subprogram, COSTADJ, calculates the cost adjustment factor which will be applied to a work package and its component major elements.

1. WHAT IS COST ADJUSTMENT?

Cost adjustment is an allowance for inflation. The cost estimate for a given project may have been made in 1977 using 1977 prices. But the building may not be built until 1981. By then prices will have increased. The original cost estimate must include an allowance equal (hopefully) to this increase. The allowance is called Cost Adjustment.*

The Cost Adjustment Rate is simply the percentage which, if applied to the basic cost estimate and compounded annually, will yield the cost adjustment.

2. INPUTS AND OUTPUTS

1) Inputs

.	Escalation Date	From the 1510 fixed data
.	Mid-point of Construction Date	From the work package line item in the detailed cost estimate data
.	Location Code	"
.	Cost Adjustment Rates, by location, by year	Cost Adjustment Table

Note: If the Mid-point of Construction is not supplied in a given work package's data, then generate the date from 1509 data. Use the Construction Start and Construction Completion dates and find the date midway between them. This step should be done by the calling program since it will likely have to be done for several work packages if it is done for any.

*Often, the situation is slightly more complicated. Often, the estimator will supply not current prices for items, but prices anticipated for 8 months hence. In effect, the basic data has already been adjusted forward a few months. The starting date for COSTADJ is thus that date some months hence. It is called the "Escalation Date" and is supplied by the engineer at the top of the 1510.

2) Outputs

- . Cost Adjustment Factor for this work package
- . Average Annual Cost Adjustment Rate for this work package.

3. THE COST ADJUSTMENT TABLE

NASA will supply the basic cost adjustment rates to be used in the program. These will be in a table in a file which is part of the 1510 package, one table per center.

The table is described in Appendix E, but its structure is this:

```

DCL 1 Record,
      2 Location Code CHAR(3),
      2 Pairs(18),
      3 Year CHAR(2),
      3 Rate CHAR(4);
  
```

Each record of the file contains rates for a different location and for up to 18 different years.

The rates will be percentages with a maximum precision of (3,1). Typical values are between 9.0 and 18.0.

4. THE TIME PERIOD

The cost adjustment depends on the number of years over which adjustments are applied. The start date and end date of this period are passed to this subprogram by the calling program.

- . Start Date. This is the Escalation Date. One date applies to the whole 1510. Do not confuse this with the 1509/1510 Date which is the date on which the form was submitted. The cost estimate may have been made some years previous.
- . End Date. This is the Mid-Point of Construction Date. There is one for each work package.

A default is provided as noted above. It is derived from dates on the 1509, as described above.

All dates are in the form MM/YY. Calculate the time period in months:

- . Consider the start date to be the first of the month. Thus 7/80 = the first July, 1980.
- . Consider the end date to be the last day of the month preceding the month given. Thus, 8/80 = the end of July, 1980

For example, if a job starts on 3/80 and ends on 11/80, its duration is 8 months (11-3).

If a job starts on 12/79 and ends on 1/80, its duration has been 1 month, all in 1979.

5. THE LOCATION CODE

The location code is a 3-character code supplied with each work package line item. The subprogram needs this code to access the cost adjustment table properly.

If the location code is missing or cannot be matched in the cost adjustment table, print an error message and end the program. The error message should list the work package line item, with headings, which is causing the problem.

6. COST ADJUSTMENT CALCULATIONS

The program must calculate two cost adjustment figures for each work package:

- . The Cost Adjustment Factor. This will not appear on the 1510. The Q1 will use it internally in TENCALC.

$$\text{Cost Adjustment Factor} \times \text{Eng'g Cost Est.} = \text{Contingency}$$

That is, when all is said and done, when all of the annual compounding and all of the time period is over, what is the ratio of that final contingency allowance to the original Engineering Cost Estimate?

- . Average Annual Cost Adjustment Rate. This figure will not be used in calculations. It appears on the 1510 in Part I, Summary, as part of the data with each work package.

This is like an annual interest rate. It is expressed as a percentage, not a decimal. It tells the user what annual cost adjustment rate would have led to the total cost adjustment shown on the form 1510 for each work package.

1) Calculate the Cost Adjustment Factor

If the cost adjustment rate were constant year after year like interest on a mortgage, then the Cost Adjustment Factor would be simply

$$(1+r)^n$$

where r =the annual rate, n =the number of years, and annual compounding is assumed. The Average Annual Cost Adjustment Rate would obviously be r .

In fact, the rate varies yearly and the period is not an integral number of years. Thus, the Cost Adjustment Factor will have to be assembled year by year. Use this formula:

Cost Adjustment Factor_(y+1)

$$= \text{Cost Adjustment Factor}_{(y)} \times \left[1 + \left(\frac{r_{(y)}}{100} \times F \right) \right]$$

where y = the calendar year of the period
 r = the cost adjustment rate in that calendar year
 as provided from the Cost Adjustment Table
 F = the fraction of the year involved.

Note that the Cost Adjustment Factor in the first year = 1.

2) Calculate the Average Annual Cost Adjustment Rate

Get this rate by simply averaging all of rates in all of the years covered by the period. This will be an adequate approximation.

7. EXAMPLE

Take a 30-month project that begins in 9/80 and ends in 3/83. The location code = CLE. Find the two cost adjustment figures.

- 1) The dates tell you that you will need cost adjustment rates for the years:

1980
1981
1982
1983

- 2) A look at the Cost Adjustment Table for this center and for location code = CLE yields, for example:

80 = 10
81 = 10.5
82 = 11
83 = 12

- 3) The Average Annual Cost Adjustment Rate is simply the average of these four rates, or 10.9%.
- 4) The Cost Adjustment Factor must be calculated year by year as follows:

First year:

$$CAF_{(2)} = 1 \times \left[1 + \left(.10 \times \frac{4}{12} \right) \right] = 1.033$$

Second year:

$$CAF_{(3)} = 1.033 \times [1.105] = 1.142$$

Third year:

$$CAF_{(4)} = 1.142 \times [1.11] = 1.267$$

Fourth year:

$$CAF_{(5)} = 1.267 \times \left[1 + \left(.12 \times \frac{2}{12} \right) \right] = 1.293$$

Thus, the program should return 1.293 as the Cost Adjustment Factor for this work package.

APPENDIX E

THE COST ADJUSTMENT TABLE

As part of its 1509/1510 program floppy, each center must set up a table of cost adjustment rates for use by the 1510 software.

1. THE FILES

FORM Q1 utility program

ADJUST Mask for use with FORM. This already exists
 and has been delivered with this spec.)

Data File LRECL=111

2. DATA FILE NAME

The data file will be named according to this format:

. G_8_79

. K_10_80

The first letter is the center code, using the FPDS project code system. The numbers are the date of the table.

The 1510 software can identify the data file by:

- . The center code appropriate to the 1510 being processed (as found in the project code for the 1510), plus
- . The underscore character in the second place, plus
- . Record length of 111.

3. FILE STRUCTURE

The file will consist of a variable number of records, one per location. Most centers will use only one or two records, ten maximum. Each record's structure:

```
DCL 1 RECORD,  
    2 Location Code CHAR(3),  
    2 Pairs(18),  
        3 Year CHAR(2),  
        3 Rate CHAR(4);
```

The location code will be all capital letters.

The year will be the last two digits of the year, such as 80, 81 or 82.

The rate will be a percentage, such as:

```
10  
9  
9.6  
10.6  
09  
09.  
09.3
```

These percentages must be divided by 100 prior to use in calculations. No greater precision than (3,1) need be accommodated

Not all of the Pairs array will be filled. Some elements may have a year but no rate; others may be entirely blank. This is OK until a 1510 needs data for a year which is blank. If needed data is not supplied, then print an error message explaining which location and year were missing. Then end the program.

The years may not be in sequence. Allow for this.

APPENDIX F

STORAGE REQUIREMENTS

Figure F-1 summarizes the data storage requirements for the 1510 application.

1. ASSUMPTIONS

- 1) Numeric data is stored in character format. This may not be the case.
- 2) There are "long" 1510's and "short" ones. Only 30% of 1510's contain cost estimating details beyond what is contained in the "Summary of Cost Estimate" portion of the form. These long writeups represent the projects which are designed by NASA engineers. Most of NASA's projects are designed by Architect/Engineer firms under contract. In these cases, the cost estimate details are provided in hard copy by the A/E.

These details are not likely to be put on the Q1 because a) NASA lacks the manpower to do so, and b) the complication and cost of having an A/E learn the Q1 and do it.
- 3) Identification data are available in the 1509 data base and are not duplicated in the 1510 data.

2. FINDINGS

The size of the average long 1510:	20,065 bytes
The size of the average short 1510:	6,345 "
Using the 3:7 ratio noted above, the size of an average 1510 is:	<u>10,461</u> bytes

3. RETENTION PERIOD

The 1510 will be kept in magnetic form until the building is built. This will be two years after approval.

APP F(2)

FIGURE F-1
1510 Storage
Requirements

1510 STORAGE REQUIREMENTS

1. NUMBER OF 1510's

	<u>One Center</u>	<u>Headquarters</u>
1) Budget Year	50	300
2) 2 Approved Years	<u>50</u>	<u>300</u>
TOTAL, ALL YEARS	<u>100</u> 1510's	<u>600</u> 1510's

2. STORAGE REQUIREMENTS

	<u>One Center</u>	<u>Headquarters</u>
1) Budget Year	523 KBytes	3,138 KBytes
2) 2 Approved Years	<u>523</u>	<u>3,138</u>
TOTAL, ALL YEARS	<u>1,046</u> KBytes	<u>6,276</u> KBytes

APPENDIX G

FLOPPY DISK

A floppy disk accompanies this specification. It contains the mask for the cost adjustment file and the word processing files which were used to create the exhibits.

Name	Records	Length	Maximum Records	First Track	Last Track	Tracks	Records/ Track
INDEX	30	40	130	0	0	1	130
DISK	30	255	30	1	1	1	30
PRINT	11	255	30	2	2	1	30
PARA	15	256	29	3	3	1	29
ENTER	9	255	30	4	4	1	30
FORMAT	10	128	55	5	5	1	55
FORM	11	255	30	6	6	1	30
ATTACH	2	255	30	7	7	1	30
CHANGE	9	255	30	8	8	1	30
FILES	2	255	30	9	9	1	30
CONTROL	6	47	125	10	10	1	125
DINDEX	22	255	30	11	11	1	30
STARS	8	255	30	12	12	1	30
TNE	33	255	60	13	14	2	30
FOOT	37	255	60	15	16	2	30
TYPE	40	255	60	17	18	2	30
TYPEWHEL	6	128	55	19	19	1	55
ALTER	7	255	30	20	20	1	30
DK	9	255	30	21	21	1	30
COPY	13	255	30	22	22	1	30
DISKCOPY	2	255	30	23	23	1	30
2	2	255	30	24	24	1	30
3	2	255	30	25	25	1	30
4	2	255	30	26	26	1	30
GLOBAL	7	255	30	27	27	1	30
1510	18	462	34	28	29	2	17
WHATIF	10	462	17	30	30	1	17
PICTURE	19	462	34	31	32	2	17
ADJUST	19	47	122	33	33	1	122
H_8_79	2	111	62	34	34	1	62

1510 = A sample 1510 printout as shown in Appendix A.
 WHATIF = A sample WHATIF printout, as shown in part 6.2.
 PICTURE= Figure 5-2, which shows the sizes of all fields on the printed 1510
 ADJUST = The mask for the cost adjustment table
 H_8_79 = A sample cost adjustment table.